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*THE RELATIONS OF YALE UNIVERSITY TO LETTERS AND SCIENCE.**

IN the mediæval convents, from which our academic usages are derived, there were annalists who noted the passing events. Dry and meager are such records—dry and meager will our annals seem unless we see in them the working of principles and methods during a period of two centuries. It will be my endeavor to set forth the relations of Yale to science and letters in such a way that with historic insight you may discover the tendency and the influence of the school in which we have been trained, and may thus appreciate its benefits more fully than ever before. I shall not follow closely the order of chronology, and under the circumstances of this address, I must omit the praise of living men, however richly deserved, nor can I mention many of the departed, however honored and beloved. Law, medicine and theology must be avoided; 'it is so nominated in the bond.' It will be good for each one of us to bear in mind the seven searching questions of an ancient critic—

Quis, Quid, Ubi, Quibus auxiliis, Cur, Quomodo, Quando,

and to remember also that there is no process by which we can draw forth in forty

* An address prepared for the Bicentennial Celebration, New Haven, October 22, 1901.

minutes the rich vintages stored up in a period of forty lustrums.

The Collegiate School of Connecticut began well; Yale College improved upon the Collegiate School; Yale University is better than Yale College. The process has been that of evolution, not of revolution; unfolding, not cataclysmic; growth, and not manufacture; heredity and environment, the controlling factors. What we are, we owe to our ancestry and our opportunities. Hence the 'Relation of Yale to Letters and Science' cannot be adequately treated without looking outside the walls, as well as inside—by considering the wilderness of Quinnipiac; the dependence of the colony upon the mother country; the bicephalous State of Connecticut; the prosperous city of New Haven and its proximity to the great metropolis; and especially by considering what has been going on in the macrocosm of literature and knowledge where we represent a microcosm. Such a survey I shall not attempt, for I must keep close bounds. Yet even brevity must not suppress the fact that among the original colonists of New Haven, the real progenitors of Yale College, were three broad-minded men of education—John Davenport, a student of Oxford and a minister in London; Theophilus Eaton, the King's ambassador at the Court of Denmark; and Edward Hopkins, a merchant of enterprise and fortune, and earliest benefactor of American learning. Their successors also, the men of 1701, James Pierpont at the front, were worthy exponents of the ideas they had inherited; they were the wisest, broadest and most learned men of this region in that day. Liberal ideas were then in the advance and, thank God, are not yet in the background.

New England brought from Old England the customs, the studies, the graduates of Oxford and Cambridge, not those of Scotland or France or Germany. The exotic germs were nurtured by Harvard for more than sixty years before the times were ripe for a second college in this region. Harvard instructors, laws, courses, phrases, were then adopted by the Collegiate School of Connecticut, and our alma mater began her life as a child of the new Cambridge and a grandchild of the old. 'Harvard has nourished Yale eighty years kindly ordered in Providence,' are the words of President Stiles. Yale has never ceased to be grateful for this noble ancestry, nor broken the chain of historic continuity. Yale does not forget that an honorable pedigree is its priceless possession, and delights to-day to honor its ancestry.

The seventeenth century was not the most brilliant period of university education in the mother country. The functions of universities had been usurped by colleges. Their scope was restricted; their regulations rigid and petty. Science and letters were subordinate to logic and grammar, and the maintenance of orthodoxy. Nevertheless, the new school made the best of it—and while still without a fixed habitation or a name, acquired both influence and reputation. It began with books, not bricks; with teachers, the best that could be had; and with ideas in respect to intellectual discipline which soon bore fruit in the service of Church and State.

The division between our first and second centuries, corresponding with the eighteenth and nineteenth centuries of our era, is not simply determined by the calendar. There are two periods to be considered as well as two centuries, each deriving its characteristics from the spirit of the age. The first of these, our forefathers went through the good old colony times of dependence upon England; the Revolution; the establishment of constitutional government; and the enlargement of national life and hope. It was the period too when a free church was to be established in a free state, when Chris-

tianity was to be promoted without the rule of hierarchy. The business of a college was to train two sets of leaders, those who would develop and administer republican government under new conditions, and those who would be ministers of the word of God among a Christian people separated from the Establishment. For scholastic discipline the books and methods approved in the mother country and adopted in Harvard were the only instruments. Such words as letters and science were not in their vocabulary. Religion and law, or as they said, the church and state, were the dominant concerns of patriot and sage.

Days of privation, anxiety, dispute, apprehension and experiment, introduced a time of stability, prosperity and union—years of plenty after years of want—and the second century opened with courage equal to opportunities. It is true that the ideas of original research, of experiment and observation, now so familiar, were hardly perceptible, but science had begun its triumphal march, and the humanities, in a broad sense, were destined to engage more and more the attention of educated men.

In the first decade, our record of 'the noble living and the noble dead' includes the name of one who was trained by alma mater for more than provincial usefulness and fame, Dr. Jared Eliot, who like the sages of antiquity, had the cure of souls and the care of bodies. A physician as well as a presbyter, living in a country town, preaching constantly, traversing a wide district on errands of mercy, he showed the qualities of an original investigator. He could ask hard questions and proceed to search for their answers; he would make no assertions that were not based upon observation or experiment, and he submitted his conclusions, by the printing press, to the scrutiny of the world. These are his sayings: "Entering on the borders of terra incognita I can advance not one step forward, but as experience, my only pole-star, shall direct. I am obliged to work as poor men live, from hand to mouth, and as light springs up before me, as I advance." Again: "As all theory not founded upon matter of fact and that is not the result of experience, is vague or uncertain, therefore it is with great diffidence that I have offered anything in way of theory which is only conjectural and shall always take it as a favor to be corrected and set right."

It is not too much to claim that he made the first contribution from this land of iron and gold to the science of metallurgy in a memoir entitled, 'The art of making very good if not the best iron from black sea sand'; and he was a century or more in advance of his times in the promotion of scientific agriculture, as any one may see by looking up the six tracts, which he published in quick succession, and afterwards collected in a volume, on 'Field Husbandry in New England.' His science did not drown his humor, and he has left this short biography of his laboratory assistant, who was skeptical about results and needed stimulus: "He being a sober man (says Eliot) who could use strong drink with moderation and temperance, I promised him if he could produce a bar of iron from the sand, I would send him a bottle of rum." Such in colonial days was the spirit that promoted research.

No wonder that Benjamin Franklin found Eliot out and wrote him affectionately, "I remember with pleasure the cheerful hours I enjoyed last winter in your company, and I would with all my heart give any ten of the thick old folios that stand on the shelves before me, for a little book of the stories you then told with so much propriety and humor." Poor Richard, when he ranked ten folios below the wit and wisdom of his friend in Guilford, paid a compliment to the collegiate school of Connec-

ticut, but he had not in mind the folios with which the college was founded.

If it be true that Eliot was chosen a member of the Royal Society of London, the distinction is very great, for only David Humphreys, among Yalensians, had the like honor before the recent triumvirate, Dana, Newton and Gibbs.

Of Jonathan Edwards, the philosopher and theologian, I have no right to speak, but he must not be exiled from men of letters, especially since it is customary in recent years to call him by the name of one of the most illustrious of epic poets. His contemporaries placed no limits on their praise, and even wrote on his tombstone *Secundus nemini mortalium*, thus transcending the well-known Florentian epitaph, *nulli aetatis suae comparandus*.

His grandson, with pardonable atavism, declares that he

> in one little life the Gospel more
> Disclosed, than all earth's myriads kenned before,

and then, alarmed by his own eulogy, he adds, "The reader will consider this proposition as poetically strong, but not as literally accurate."

Edwards may be called a poet suppressed. His writings are often noteworthy for the graceful language in which refined thoughts have expression, and although no rhymes or verses of his are extant, some passages have a Miltonic ring. The most orthodox among us may hazard the opinion that his visions of the future state are fitly classified as works of the imagination.

Many years ago this extraordinary man was likened by Dr. Samuel Osgood, of New York, to Dante, and this comparison has been recently amplified in two brilliant addresses by Dr. Allen and Dr. Gordon in the commemoration of Edwards at Northampton, a century and a half after his banishment. A cooler critic has called him a great glacial boulder, one of the two huge literary boulders deposited in New England thought by the receding ice of the eighteenth century. These striking terms may excite a smile, but they are not uttered carelessly, nor are they misfit. The logic of Edwards is like a rock, fixed as those masses of stone upon yonder hill where the regicides took refuge, hard to move and not easily broken up. Cotton Mather was his fellow traveler upon the ice fields which once covered New England, leaving scratches and furrows on many an eminence.

It is pleasanter to think of the flaming preacher as the Dante of New England. His language often glows with fire; his words burn; his fancy carries him to the borders of the Inferno and to the gates of Paradise. Nor is this all we can say. Our Dante had his Beatrice, and the words in which he speaks of her may well be placed in a parallel with that which narrates the love of the Italian for the daughter of Folco. Hear the earliest record that has come down to us of Dante's precocious and enduring love. "She was perhaps eight years old, very comely for her age and very gentle and pleasing in her actions, with ways and words more serious and modest than her youth required; and besides this, with features very delicate and well formed, and further so full of beauty and of sweet winsomeness that she was declared by many to be like an angel." "Although a mere boy, Dante received her sweet image in his heart with such appreciation that from that day forward it never departed thence while he lived."

Four centuries after Dante, Jonathan Edwards made this note in respect to the New England maiden of fourteen years, who became his wife. "They say there is a young lady in New Haven who is beloved by that Great Being who made and rules the world, and that there are certain seasons in which the Great Being comes to her and fills her mind with exceeding great delight. * * * She is of a wonderful sweetness,

calmness and universal benevolence, especially after this Great God has manifested Himself to her mind. She will sometimes go about from place to place, singing sweetly, and seems to be always full of joy and pleasure, and no one knows for what. She loves to be alone, walking in the fields and groves, and seems to have some One invisible always conversing with her."

Dante and Edwards alike in love, alike in their spiritual fervor, and in their impressive imagery, were alike in exile—both were driven from their homes, both died among strangers, both have been honored with increasing reverence by the descendants of those who rejected them.

In his youth Edwards showed a noteworthy proclivity toward the study of nature. An article is extant which he wrote at the age of twelve, recording his observations upon spiders and displaying the same qualities as those of Lubbock and Maeterlinck. Moreover, his undergraduate notebook gives evidence that his mind was alert for knowledge in other fields, and that he could ask searching questions in physics, including electricity, meteorology, physical geography and vegetation. One who was familiar with these precocious memoranda remarks that if they were written, as supposed, between the ages of fourteen and sixteen, 'they indicate an intellectual prodigy which has no parallel.' If he had been taught to use the lens and the meter as he used the lamp, he might have stood among the great interpreters of nature—the precursor of Franklin, Rumford and Rowland.

He was nurtured by theological dialectics, and he excelled not in physics, but in metaphysics, so to-day instead of honoring him as a leader in literature or science, we can only acknowledge with filial reverence, his wonderful influence upon the opinions and characters of six generations. The laws of intellectual inheritance are obscure, and the influences he has handed down cannot be measured. It is, however, noteworthy that three of his descendants occupied the presidential chair of Yale for nearly sixty years, many others have been among our teachers; indeed there are few years in our second century in which the faculty has not included one or more of his posterity. I have read the printed verses of seven of his descendants—no small part colored (may I be pardoned for saying so) with the cerulean hue of religious fervor.

It is interesting to dwell upon the names of Edwards and Eliot as men of more than provincial fame, because the number of Yalensians who can be regarded as contributors to literature and science prior to the Revolution is small. The historian, Tyler, has taken the year 1765 as the close of the sterile period, when colonial isolation was ended and American literature began to be worthy of the name. Before that time neither Harvard nor any of the other colleges has much to speak of; yet afterwards, until the close of the eighteenth century, the product is almost as scanty. A recent paper enumerates the texts by which the youthful minds were disciplined.* Although the manuals and the methods were not inspiring, they encouraged discrimination and that power which used to be called ratiocination, 'generation of judgments from others actually in our understanding.' You may say that this is not 'experimental science nor literary culture,' and you say well. The ore, indeed, may have been extracted by the Eliot process, from black sand, but the Bessemer process had not been invented for turning iron into steel; nevertheless, we have the assurance of a recent Massachusetts critic,† that the highest literary activity of the later eighteenth century had its origin at Yale College.

* By Professor Schwab.

† Barrett Wendell.

Our elder brethren of the eighteenth century, with whom most of us have no more acquaintance that we get from the hortus siccus of a biographical dictionary, were men quite as intellectual as men of our day. When their acquaintance is cultivated and when the minute incidents of their lives and their quaint characteristics are sought out, they are as interesting as our contemporaries. Let us cease to regard them as mummies. The story of Manasseh Cutler is a succession of romantic incidents. Bishop Berkeley's transitory interest in the college and his permanent influence upon it is a captivating record. Jeremiah Dummer, little more than a name to most of us, was called by Charles Chauncey one of the three greatest New Englanders. The story of Liberty Hall, where William Livingston lived with his charming family of daughters, might be commended as the basis of a novel to the author of Hugh Wynne. Rector Clap, the fighting rector, led a life full of racy incidents, and certainly we have no more picturesque character on the roll than Dr. Stiles, now reintroduced by Professor Dexter to the society of which he was once a distinguished ornament—that extraordinary polyhistor to whom all knowledge was attractive, all tongues appetizing and all events pregnant.

As we recall the writers of influence and distinction among our brethren, we cannot fail to observe the dominant religious spirit which most of them show, and it may be well at the outset to remind you that the identity of theology and poetry is not peculiar to New England. The earliest biographer of Dante declared that 'theology was nothing else than the poetry of God.' 'Not only is poetry theology, but theology is poetry,' says Boccaccio, and then he adds that if these words of his merit but little faith, 'the reader may rely on Aristotle, who affirms that he had found that poets were the first theologians.' Judged by this standard, we might find a good deal of poetry in our Yalensian products, during the eighteenth century, but by the criteria of modern scholarship, not much that would be commended by Matthew Arnold, not much that our own anthologist would cull for preservation.

Before the middle of our first century there appeared in New York a volume containing seven hundred lines of verse, entitled 'Philosophical Solitude; or the choice of a rural life: by a gentleman educated at Yale College.' This anonymity did not long conceal the authorship of William Livingston, one of the brightest students of his time, distinguished in many ways—once as 'the Presbyterian lawyer,' and later as Governor of New Jersey and member of the Constitutional Convention. His brother, also a Yalensian, was a signer of the Declaration. The verses show the influence of Pope, and among other points of interest in them, are allusions to the writers whom this young graduate desired for his intimate friends in the rural life he intended to lead.

In the Revolutionary War, two of our brethren, while acting as chaplains, were composers of patriotic songs. Many years later, the inspiration of the muses descended upon a number of recent graduates, who became known as 'the Hartford wits,' —'four bards with Scripture names,' John, Joel, David and Lemuel, any one of whom could produce an epic as surely, if not as quickly, as the writer of to-day would compose an article for the Yale *Review*. The group included John Trumbull, a precocious youth fitted for college at the age of seven, whose burlesque treatment of the Revolutionary war called 'McFingal,' ran through thirty unauthorized editions; the versatile Joel Barlow, author of 'Hasty Pudding,' who worked for half his life, we are told, upon the 'Columbiad,' having in the interval of his engagements adapted Watts's Psalms to the use of Connecticut churches

and added several original hymns; David Humphreys, who translated a French tragedy, entitled the 'Widow of Malabar,' and composed several ambitious poems; and finally, Lemuel Hopkins, an honorary graduate. The Harvard historian whom I have already quoted has said that at the time the Hartford wit wrote, no Harvard man had produced literature half as good as theirs.

Perhaps one may, without offence, at this late day, refer to the ponderosity of this early poetry. 'McFingal' and 'Hasty Pudding' and the 'Progress of Dulness' would hardly be found amusing in these days, although they were mirthful. 'Greenfield Hill' is hard reading. The seriousness of such subjects as the 'Conquest of Canaan,' the 'Vision of Columbus,' the 'Anarchiad,' and 'The Last Judgment, a Vision,' was characteristic of the times and was adequately sustained by the serious treatment to which these themes were subjected. Indeed, in this period, lofty ideals were entertained, and long and elaborate poems were so naturally attempted that a commencement orator (as late as 1826) delivered a discourse on 'some of the considerations which should influence an epic or a tragic writer in the choice of an era.' The spirit of Hebrew poetry hovered over our elms, more constant than Calliope or Euterpe. It suggested dramas, which have died, it found expression in hymns, which have lived. I could name five of these. Brethren, answer the question of Emerson—

> Have you eyes to find the five
> Which five hundred did survive?

At the beginning of our second century we come upon the name of John Pierpont, preacher, patriot, advocate of every cause which would improve his fellow men, whose verses are at the front of two recent anthologies. Bryant just missed enrolment among us. He took a dismissal from Williams in order to enter Yale, but he did not fulfil his purpose. Fitzgreen Halleck, a native of this county, did not go to any college. Not long after Pierpont, the two Hillhouses were graduated. The elder, James, was author of 'Percy's Masque' and three other dramas, the last of which, entitled 'The Judgment, a Vision,' was intended (says the author) to present 'such a view of the last grand spectacle as seemed most susceptible of poetical embellishment.' He was a gifted writer of fine taste and lofty ideals; and his writings were most highly esteemed by the generation to which he belonged. His name is dear to us as the poet of Sachem's wood, the beautiful park at the head of Hillhouse Avenue—the park and the avenue alike commemorating his distinguished father, to whom the city of Elms is beyond estimate indebted. For East Rock and West Rock he suggested the names of 'Sassacus' and 'Regicide.'

Later came Brainard, cut down in his youth, and brought to life at the call of Whittier; and William Croswell, son of the rector of Trinity Church, one of the most cultivated of churchmen, whose poems, ten years after he died, were edited by Bishop Coxe. In the class of 1820 were two men whom we honor for so many other reasons that we forget their poetry—Woolsey and Bacon. As the first quarter of the century closed, the college diploma was given to James G. Percival, that unique, eccentric, impracticable combination of science and literature, learned to superfluity, versatile to inconstancy, loving nature, books, words, yet disliking men as he met them; geographer, geologist, linguist, lexicographer, poet, with much of the distinction and a fair amount of the infelicity which characterizes genius. His metrical studies are remarkable illustrations of the Laws of Verse. Next came N. P. Willis, graceful in prose and verse, remembered by some for his Biblical lyrics, and by others

for lines in praise of New Haven elms; and soon, Ray Palmer, whose sacred song has been translated into twenty languages, and sung in Arabic, Tamil, Tahitian, Mahratta and Chinese, as well as in the tongues of Christendom. George H. Colton, one of a family that has cultivated the muses, published a poem on Tecumseh soon after he graduated in 1840. Twenty years later came Weeks and Sill—Weeks who died before he had stretched his wings for the flights of which he was capable; and Sill, bright and beloved Sill, whose verses, collected since his death, exhibit as do his essays and letters, an intellect strong, unconventional and suggestive. These are not all the departed whom we may hold in honorable remembrance.

It is no part of my plan to say much about the living, but there are two writers entitled to special mention—Finch, the author of stanzas which have brightened the fame of Nathan Hale; and Stedman, anthologist and historian of Victorian poetry, the poet of yesterday and to-morrow, the youth who won his laurels as an undergraduate writer in the *Yale Literary Magazine;* the singer who wears them still upon his frosty brow.

The comparison has been made between the graduates of Havard and of Yale, and the long and brilliant list of historians and poets of Cambridge has been contrasted with the shorter and less famous list of New Haven. Our friends at heart will doubtless attribute something, as is their wont, to the proximity of Boston, a beacon set upon the hill, a port of entry for the culture of other lands, where the Athenæum, still foremost among the society libraries of the United States, was an inspiring resort, close akin to the London Library, giving to men of letters both sustenance and stimulant. It, is however, probable that the difference between the two colleges is due to the fact that in Eastern Massachusetts during the last century dogmatic theology has been neglected and the ablest intellects have been free to engage in literary production. Perhaps this is true. I do not know. We may claim this, however, without making any comparison, that Yalensians from the beginning were brought up in obedience to 'Duty, stern daughter of the voice of God'; that the College was founded for the fitting of men to serve the church and state, and that the graduates of Yale, whether famous or unknown, are devoted to the service of their country and show that they have been trained to think, to reason, to write and to speak with freedom and with force. We can every one of us recall classmates and friends, men we have heard and men we have heard of, who have been like village Hampdens, or mute inglorious Miltons; and we can also recall those who have shown, at the bar and on the bench, in the cabinet and in diplomacy those qualities which under other conditions would have made them orators and authors. The point I make is this, that the Yale training has tended to the development of strength rather than of grace. "I thank God" said a famous preacher who studied in both places, "that I struck no literary roots at Yale and no theological roots at Harvard." "I thank God too," said one of his teachers at New Haven.

It is certainly true that hundreds of the graduates of Yale have been accurate and forcible writers, who have known what to say and how to say it; and that they have in this way rendered an incalculable service to the country, far and wide, even though we admit that, under the pressure of strenuous life, but few of them have shown those literary qualities which are usually evoked where writers and critics come in close relation to one another, as they do in cities and in large universities. Long ago, Bishop Fraser said of the United States, that the people were the most generally edu-

cated, if not the most highly educated, people in the world. Something like this we may say of the Yale alumni—if they number few men of genius, they number many men of talents, usefulness and power; if there are none who are equal to Tennyson and Schiller and Victor Hugo, there are many who have been the advocates of truth and the promoters of social reform, in terse and vigorous English. They have excelled in the pulpit and at the bar, and in the halls of legislation, so that without mentioning the names of men whom we have personally known, I will remind you of that long line of jurists and statesmen who were living near the beginning of our second century, William Samuel Johnson, Pelatiah Webster, John C. Calhoun, James Kent, Jeremiah Mason, and that constellation of New England theologians, an innumerable host, from Edwards to Taylor.

Professor Kingsley was called the Addison of America, and he had such wit, knowledge and grace as might have given him distinction in literary composition if he had so directed his energy; but he was one of those 'generally useful men' that this college produces, who held at one time what we should call four chairs. We should all be proud to claim as the product of our alma mater James Fenimore Cooper, but we cannot, for like Shelley from Oxford, he was driven out because of a boyish misdemeanor. Professor Kingsley once told me this story: The novelist Cooper, Judge Kane, of Philadelphia, and Hon. John C. Spencer, of New York met at a dinner. 'Where were you educated?' said one. 'I had the honor of being turned out of Yale College,' was the reply. 'And so did I,' said the second; and 'I had the same honor,' said the third. *Hæc fabula docet* that boyish liveliness is not always fatal to mature success. If we cannot claim Cooper, Theodore Winthrop is ours—the essayist and novelist, whose posthumous fame shows what was lost to letters when he died a patriot's death upon the field of battle.

Lounsbury says that Cooper left Yale with little learning in his head and then he wittily adds, "No one will doubt this who has learned to view with profoundest respect the infinite capability of the human mind to resist the introduction of knowledge."

In the second quarter of the nineteenth century the influence of Coleridge is apparent. William Adams, Horace Bushnell, Lyman Atwater, William Watson Andrews and Noah Porter are conspicuous examples of this infusion of idealism. Their writings are in evidence. The powerful imagination which produced 'The Ancient Mariner' and 'Christabel' had been directed to the transcendent study of the Infinite, and many who turned away from the most rigid tenets of Calvin, and from the literal interpretation of the Old Testament, were strengthened and guided by the philosopher of Highgate. Bushnell confessed greater indebtedness to the 'Aids to Reflection' than to any other book—save the Bible. Of the theological emancipator, I am not called upon to speak—of the gifted writer more than passing mention must be made. His sermons, addresses and essays always arrested the attention and excited the imagination of those who heard and those who read them. For example, his estimate of Connecticut, his 'Age of Homespun,' indeed all the contents of his 'Work and Play,' and many parts of 'Nature and the Supernatural,' glow with life and fancy, and will be as good reading for our grandchildren as they were for our fathers. The incisive notes of his voice as I first heard it when an undergraduate, still ring in my ears—and his racy sentences, his inspiring and suggestive phrases, and the eloquence of his thoughts were even more impressive than his voice. The name of Horace Bushnell

is a precious heirloom handed down from the Yale of the last century to the Yale of the present. He was an orator, a poet, a lover of nature, and of man—fearless, original, persuasive, too liberal for the conservatives, too conservative for the liberals of that day, now honored in both their schools. Horace Bushnell is the greatest of this group. Indeed I should place him, in genius, next to Jonathan Edwards.

Not a few of our brethren have excelled in historical writing. Stiles wrote a history of the exiled Judges, and Benjamin Trumbull the history of Connecticut; Samuel Farmer Jarvis was designated historiographer of the Episcopal Church; Moses Coit Tyler is the historian of American literature; Andrew D. White is the defender of science versus bigotry, whose history should make us grateful that Yale has been one of the most important American agencies for the emancipation of the human intellect from ignorance and dogmatism; Charles L. Brice is the exponent of Gesta Christi; George P. Fisher, an honored member of the faculty for almost fifty years, stands in the foremost rank among the ecclesiastical historians of this country, and Leonard Bacon, the Puritan, always remarkable for clearness and vigor, whether religion or politics was his theme, is the author of discourses on the early days of New Haven, which remain unsurpassed in the field of local history. He was like a modern Isaiah, the trenchant defender of political righteousness. Stillé's pamphlet, 'How a Free People conduct a Long War,' was one of the most inspiring products of the uprising for the Union; and Schuyler's studies in Turkistan and his essays in diplomacy are enduring memorials of another 'all round man,' observer, critic, traveler, essayist, historian, diplomatist—good in whatever he undertook.

Comparative philology was introduced among us by Josiah W. Gibbs, but the chief impulse in this direction came from Salisbury, the first to teach Sanskrit in America. He recognized the ability and secured the services of one who was not a graduate, it is true, but an adopted son, whose honors are our honors, whose fame carries the name of Yale to every university of the Indo-European world, that illustrious scholar, William D. Whitney. We must remember that James Murdock in 1851 published a translation of the Peshito Syriac version of the New Testament; that Moses Stuart at an earlier day carried from New Haven to Andover, an enthusiastic, if not always accurate, devotion to Biblical literature; and that a learned and devoted scholar, Eli Smith, within sight of Mt. Lebanon, translated nearly all the Bible into Arabic, as in later days Hiram Bingham translated it into one of the languages of the Pacific Ocean.

Another interesting phase of philological study is shown in the attention given to the study of the languages of the North American Indians. This began very early, when Sargent, Brainard, Spencer and Edwards were engaged as missionaries to the aborigines in Western Massachusetts and in Central New York. The philological importance of the American speech was recognized in recent days by James Hammond Trumbull, who with rare aptitudes for the elucidation of knotty problems, directed his attention to the Indian languages of the Eastern States, and was soon acknowledged as foremost in that uninviting and perplexing field of inquiry. Before long we shall have his lexicon of the Natick Speech, so that he who will may cultivate the love of comparative literature by reading Eliot's Indian Bible. Daniel G. Brinton in other branches of aboriginal research has also won renown.

An unusual manifestation of the love of letters is shown by the attention given during the last century to lexicography. For

a time Yale was a veritable storm-center. Webster versus Worcester, and Worcester versus Webster were chieftains in this 'Battle of the Books,' and both authorities were graduates of Yale. Lately, Whitney, W. the Third, has taken rank with the best antecedents, and a score of cooperative Yalensians, many of them specialists, have been engaged in the improvement of the three great dictionaries. It is customary to laugh at the changes in spelling proposed by Noah Webster, and certainly some of the Johnsonese definitions which he propounded were mirth-provoking—('sauce,' for example)—but revised and improved by Goodrich, Porter, Kingsley and others, his dictionary holds its own. Its popularity was due in part, no doubt, to Webster's spelling book, of which the annual sale at one time was twelve hundred thousand copies. By this primer a very great service was rendered to letters—for it helped to counteract any tendency toward provincial or dialectic peculiarities among the heterogeneous people of the United States.

Apart from theology, philosophy has engaged the attention of many of our ablest brethren. This is especially true of the time since Porter was called to the professorship which he held with conspicuous distinction for almost half a century, including the years of his presidency. A recent investigator has traced the influence of this able teacher, well versed in the modern writers of Germany, who made metaphysics interesting to those who were indifferent, and at his best in the analysis of conflicting theories and in the detection of subtle errors. As a lawyer for the defense, he would have been the peer of Rufus Choate. Not a few of his pupils have been led through philosophy to pedagogics and are winning distinction in this field.

This review would be incomplete if I did not mention the *Yale Literary Magazine*, which for more than three score years has kept up the love of literature among the undergraduates, and has furnished them with appreciative readers, critical enough and friendly enough for discipline. Many editorial writers have been trained by their service on this magazine, since Evarts set the press in motion. Older Yalensians have had their opportunities in magazines of wider circulation, the *Christian Spectator*, the *New Englander* and the *Yale Review*, not officially connected with the college, but supported by the faculty.

The literary societies also, which for more than a century were maintained with vigor, seem to me to have been one of the very best agencies for youthful discipline. The spontaneous efforts of young men, excited by the emulation of their comrades, and controlled by the friendly criticism of their peers, were admirable exercises for the development of the love of poetry, oratory, essay writing and debate.

One of the greatest services which this college has rendered to literature and science has been the preparation of an innumerable host of teachers and professors. The list is too long for recapitulation here—but a few names must be recalled. The earliest was Jonathan Dickinson, first president of Princeton, deemed in his time the peer of Edwards, whose immediate successors were likewise Yalensians. Next came Samuel Johnson, the friend of Berkeley, first president of Columbia University, elected president of the University of Pennsylvania, and his more famous son, William Samuel Johnson, who succeeded to the presidency of Columbia, and stood in the first rank among the statesmen of the period just subsequent to the Revolution. From the Wheelocks, of Dartmouth to Sturtevant, of Illinois, Chauvenet, of St. Louis, and Chapin, of Beloit, the file leaders in our colleges have constantly been elected from Yale. At a recent date lived Thomas H. Gallaudet,

pioneer in the instruction of deaf mutes, and Henry Barnard, ever to be associated with Horace Mann, as advocate, expounder and promoter of the American system of common schools. Nor can I forget Henry Durant, and the other graduates of this college, who went to the Pacific coast, 'with college on the brain,' and planted in California the seeds of learning which now bear harvests of golden grain. A happy thought gave the name of Berkeley to the site near the Golden Gate, where an institution begun by our brothers fulfils the remarkable prophecies of Timothy Dwight, written in 1794:

All hail! Thou Western World! by heaven designed
The example bright to renovate mankind!
Soon shall thy sons across the mainland roam
And claim on fair Pacific's shore a home.

Where marshes teemed with death, shall meads unfold,
Untrodden cliffs resign their stores of gold.
Where slept perennial night, shall science rise,
And new-born Oxfords cheer the evening skies!

Let us turn from letters to science. As I scan the administrative records, from the beginning onward, with the aid of our right well beloved and trustworthy archivists, the two Kingsleys and Dexter, when the scepter passes from one president to another, the balance is kept true. Pierson was an exponent of geometry and a defender of the faith, who wrote out lectures upon physics, and dictated them to successive classes; Cutler's short service gives little indication of his attitude; Williams loved public life more than academic perplexities; Clap was a writer on ethical and astronomical subjects, a student of the Bible, scarcely equalled, says his successor, in mathematics and physics by any man in America; Daggett, extremely orthodox, was scientific enough to warn his townsmen, scared by 'the Dark Day,' not to be alarmed nor 'inspired to prophesy any future events—till they should come to pass'; Stiles was familiar with every department of learning, 'theology, literature, science, whatever could interest an inquisitive mind * * * he included among the subjects of his investigations';* the elder Dwight is well known for the impulse that he gave to the expansion of the college in all directions; the judicious Day was the author of a metaphysical study and of mathematical text-books; Woolsey is distinguished as the promoter of classical literature, and at the same time as the president under whom the School of Science was developed; Porter and the younger Dwight brought the University forward to its present comprehensiveness and influence in all branches of knowledge. Indeed, science and letters have always been the care of the corporation, and such will be the care while the helm is held by the discerning and vigorous pilot under whom the bark begins another voyage and so long as the alumni crew support the master and the mates.

Considering the hesitation with which the English universities recognized the study of nature as their concern, and how easy it is to awaken hostilities between the students of science and letters, or between ecclesiastics and naturalists, it is well to remember how early science came into the Yale curriculum, and how steadily it has held its place. A chair of mathematics, physics and astronomy was instituted thirty years before the professorship of ancient languages. As it is pleasant to associate the name of Sir Isaac Newton with the beginning of our library, it is likewise pleasant to remember Benjamin Franklin as a donor of scientific apparatus. 'Immortalis Franklinus' he was called by Stiles.

Before the college was fifty years old he became its valued friend, and was enrolled among the laureati in 1753. Four years previous, he had sent here an electrical

* J. L. Kingsley.

machine which enabled the young tutor, Ezra Stiles, to perform the first electrical experiments tried in New England. A Fahrenheit thermometer was a subsequent gift, and his influence led the University of Edinburgh to confer upon Stiles a Doctor's degree.

At the dawn of scientific activity in New England we see the commanding and attractive figure of our elder brother, Manasseh Cutler, storekeeper, lawyer, soldier, statesman, pastor, preacher, physician and naturalist, member of the Legislature and of Congress, appointed to the federal bench, advocate of the 'homestead' policy, and a pioneer among the settlers of the wilderness of Ohio. His greatest distinction is the part that he took in drafting and passing the ordinance of 1787, by which slavery was excluded from the Northwest Territory and a grant of the public domain was secured for the promotion of education. That is a record to be proud of, brethren of the Alumni, but it does not include the whole story. Cutler, a man of the true scientific spirit, an observer of the heavens above and of the earth beneath, is the father of New England botany. He made a noteworthy contribution to the memoirs of the American Academy, collected and described between three and four hundred plants of New England, and left seven volumes of manuscript notes, which are now in the Harvard herbarium, awaiting the editorial care of a botanical antiquary. Franklin and Jefferson valued him as a friend, and his correspondents in Europe were among the chief naturalists of the day.

About the beginning of the nineteenth century, Dwight and his three professors, who only uttered *sotto voce* the word university (though Stiles had written it in 1784), lest they should be regarded as pretenders, introduced a new era in which the progress has been constant and of increasing rapidity. In this new era, classical studies have been promoted by Kingsley, the lover of antiquity, whose keen sword defended the study of classics; Woolsey, the lover of letters, who introduced to us Plato and the dramatists of Greece; Thacher, the lover of students; Hadley, the lover of lore; Packard, the lover of learning — and by the accomplished standard bearers still living; and science likewise had its skilled promoters: Silliman, leader in chemistry, mineralogy and geology, the alluring teacher, the captivating lecturer, unsurpassed by any, equalled only by Agassiz; Olmsted, the patient, inventive instructor, whose impulses toward original investigation were not supported by his opportunities; Loomis, interpreter of the law of storms and master of the whirlwind; Dana, the oceanographer, who wore the tiara of three sciences; Newton, devoted to abstract thought, who revealed the mysteries of meteoric showers and their relation to comets, not before suggested; and Marsh, the inland explorer, whose discoveries had an important bearing on the doctrine of evolution—these all with the brilliant corps of the Sheffield Scientific School were men of rare ability who expounded and illustrated the laws of nature with such clearness and force that the graduates of Yale are everywhere to be counted as for certain the promoters of science.

Two agencies are conspicuous in the retrospective of this second era, the *American Journal of Science*, and the Sheffield Scientific School. Benjamin Silliman showed great sagacity when he perceived, in 1818, the importance of publication, and established of his own motion, on a plan that is still maintained, a repository of scientific papers, which through its long history has been recognized both in Europe and in the United States, as comprehensive and accurate; a just and sympathetic recorder of original work; a fair critic of domestic and foreign researches; and a constant promo-

ter of experiment and observation. It is a unique history. For more than eighty years this journal has been edited and published by members of a single family—three generations of them—with unrequited sacrifices, unquestioned authority, unparalleled success. In the profit and loss account, it appears that the college has never contributed to the financial support, but it has itself gained reputation from the fact that throughout the world of science Silliman and Dana, successive editors from the first volume have been known as members of the faculty of Yale. I am sure that no periodical, I am not sure that any academy or university in the land has had as strong an influence upon science as the *American Journal*.

A century has nearly passed since Benjamin Silliman was chosen a professor and went to Scotland, there to fit himself for the duties of the chair. What a century it has been! The widespread interest among our countrymen, in geology, mineralogy and chemistry is due in no small degree to his instructions here, and to the lectures that he delivered in every city between Boston and New Orleans.

The Sheffield school celebrated three years ago its semicentennial, and its useful services were rehearsed by one who will not venture to offer you a twice told tale. You must, however, permit him to remind you that fifty years ago the choice of studies was but timidly permitted in the traditional college, and that there was a strong demand for courses less classical, more scientific than were then offered. These wants the school supplied without antagonism or rivalry, though not without the awakening of alarm. It proved to be a rich addition to the resources and the renown of Yale, as every one admits. Its faculty was made up chiefly of men whose ideas were broad, whose distinction was acknowledged, whose methods were approved, and this, with the munificent support of the benefactor whose name the school has been proud to bear, enabled Yale to stand forth as the ready, wise and resolute promoter of education in science. The alumni of the school are the proofs of its success.

Agricultural science in the United States owes much to the influences which have gone out from the Sheffield School. John P. Norton, John A. Porter, Samuel W. Johnson, William H. Brewer, each in his own peculiar way, has rendered much service. Johnson is preëminent, and in addition to his standing as a chemist, is honored as one of the first and most persuasive advocates of the experimental stations now maintained, with the aid of the Government, in every part of the country. We cannot forget the value of 'the crops'—we may forget how much their value has been enhanced by the quiet, inconspicuous, patient and acute observations of such men as those whom I have named, the men behind the men who stand behind the plow. They are the followers in our generation of Jared Eliot, the colonial advocate of agricultural science.

In the thirties there was an informal association which may be called a voluntary syndicate for the study of astronomy. Its members were young men of talents, enthusiasm and genuine desire to advance the bounds of human knowledge, but their time was absorbed by various vocations, and their apparatus seems lamentably inadequate in these days of Lick and Yerkes, of spectroscopes, heliometers and photography. Yet we may truly claim that the example and success of these Yale brethren initiated that zeal for astronomical research which distinguishes our countrymen.

The Clark telescope, acquired in 1830, was an excellent glass, though badly mounted, and was then unsurpassed in the United States. One of its earliest and noteworthy

revelations was the appearance of Halley's comet, which was observed, from the tower in the Athenæum, weeks before the news arrived of its having been seen in Europe. This gave an impulse to observatory projects in Cambridge and Philadelphia, and college after college soon emulated the example of Yale by establishing observatories in embryo, for the study of the heavens. The most brilliant luminary in the constellation was Ebenezer Porter Mason, a genius, who died at twenty-two, having made a profound impression on his contemporaries by discoveries, observations, computations and delineations. After his death, which was lamented like that of Horrox, it was not thought an exaggeration to compare his powers with those of Sir William Herschel —or even of Galileo. Under the leadership of Olmsted, Herrick, Bradley, Loomis and Hamilton L. Smith were associate observers, and they were afterwards reinforced by Twining, Lyman and Newton. Chauvenet became a writer and teacher of renown, and Stoddard carried to the Nestorians the telescope that he had made at Yale under the syndicate's influence.

The investigations of these astronomers were directed to the aurora borealis, the zodiacal light, the recurrence of comets, the meteoric showers, and the possible existence of an intra-mercurial planet. Newton became the most distinguished of the group. Partly by antiquarian researches in the records of the past, continuing the notes of Herrick, partly by mathematical analysis and a careful comparison of the paths of meteors he determined the periodicity of these mysterious and fascinating phenomena, and their relation to comets.

The astronomical syndicate of Olmsted and his pupils was long ago dissolved, but its spirit hovers near us, and beyond Sachem's wood, in the Winchester Observatory, skilled astronomers with their great heliometer are engaged upon problems which were not even thought of by the discerning intellect of Mason and his brilliant confreres.

In the science of mineralogy Yale has long maintained the American leadership. Every one of us has heard the story of the candle-box of specimens, which Silliman carried to Philadelphia to be named, and every one of us has seen the subsequent accretions to the nucleus, beginning with the Gibbs cabinet, now shown in the Peabody Museum. No one is likely to overestimate the influence of this collection upon the mind of James D. Dana, nor to overestimate the value of his treatise on mineralogy which, revised and enlarged by able cooperators, continues to be a standard text-book in every country where mineralogy is studied.

In view of its recent acquisition, I am tempted to speak of the Museum as the 'House of the Dinosaur.' Its choice collections give an epitome of the sciences of mineralogy, crystallography, meteoroids, geology, paleontology and natural history, from the days of Silliman to those of the Danas, Brush, Marsh and Verrill.

The heart of a university is its library. If that is vigorous, every part of the body is benefited. Our college began with books; the incunabula were given by the founders, good books no doubt, if not a single volume relating to classical literature or the sciences was among them. Noteworthy accessions came at an early day, some of them from Elihu Yale. Think of eight hundred volumes sent from England, including the gifts of many famous writers. Remember such donors as Sir Richard Steele, of the *Spectator*, and the great Sir Isaac Newton, and then be grateful to forgotten Jeremiah Dummer, who collected and forwarded this precious invoice. Fifteen years later than Dummer's donation came nine hundred volumes from Bishop Berkeley, which with his bequest for scholarships and prizes, entitle him to receive the highest praise as

an early and liberal promoter of the humanities. Renewed homage should now be given to the benefactor whose timely and catholic bounty enriched this adolescent college. Therefore, let us repeat once more the verse of Alexander Pope and ascribe 'to Berkeley, every virtue under heaven.' Gratitude to this great philosopher shall not diminish our acknowledgments to that long line of donors who have made the library worthy of the university which has grown up around it.

Bibliographers and librarians are the servants of the temple—*servi servorum academiæ*—and such as Edward C. Herrick, Henry Stevens, William F. Poole, and James Hammond Trumbull, are rare men, conspicuous among the promoters of historical research.

In controversial periods the attitude of Yale has been very serviceable to the advancement of truth. The Copernican cosmography was probably accepted from the beginning, although elsewhere the Ptolemaic conceptions of the universe maintained their supremacy, and the notes which Rector Pierson made on physics when he was a student in Harvard come 'between the Ptolemaic theory and the Newtonian' (Dexter). When geology became a science, its discoveries were thought to be in conflict with the teachings of the scripture. Ridicule answered the arguments of science, and opprobrium was thrown upon the students of nature. Brave Silliman stood firm in the defense of geology, and although some of the bastions on which he relied became untenable, the keep never surrendered, the flag was never lowered. When the modern conceptions of evolution were brought forward by Darwin, Wallace and their allies, when conservatists dreaded and denounced the new interpretation of the natural world, the wise and cautious utterances of Dana at first dissipated all apprehensions of danger, and then accepted in the main the conclusions of the new biological school. The graduates who came under his influence were never frightened by chimæras. Marsh's expeditions to the Rocky Mountains, and his marvelous discoveries of ancient life, made the Peabody Museum an important repository of geological testimony to the truth of evolution.

I remember the surprise of Huxley in 1875 when, at a dinner of the X Club in London, I told him of Marsh's discovery of the fossil horse. In the following year, the great English naturalist came to New Haven to see in the Peabody Museum that of which he had heard and read. In his lectures at New York he soon described the work of Marsh, and subsequently referred to its important bearings.

Scant justice has been done in this discourse to the sciences promoted at Yale—and the deficiency is the more apparent when I think of the men now living whose work has been precluded from our scope. The next centennial discourse will do justice to them. Among the departed whose careers were made outside the walls of Yale, Percival, the geologist of Connecticut and Wisconsin; J. D. Whitney, the geologist of California; Chauvenet, the mathematician; Hubbard, the astronomer; Sullivant, the chief authority in mosses as Eaton is in ferns; F. A. P. Barnard, the accomplished president of Columbia; Eli Whitney, the inventor of the cotton-gin, and S. F. B. Morse, whose name is familiar from its relation to the electric telegraph—are especially entitled to honorable mention in this jubilee. So is a much older graduate, David Bushnell, the inventor of submarine explosives—the precursor of the modern torpedists.

There is a good deal to think about in the annals of Yale. It is not a perfect record. Deficiencies, errors, failures are met with from time to time—such as are

found in every human institution, even in those most sacred. It is not my business to seek them or point them out. It is rather my privilege to honor the good men that have built up for us and for our successors this great edifice, upon the firm foundations of devotion and faith; to admire the skill, the prudence and the honesty with which inadequate resources have been husbanded; and especially to appreciate that admirable union of conservative and progressive forces which keeps hold of that which is good until the better is reached, that believes in the study of nature and all its manifestations, and of man and all that he has achieved in language, philosophy, government, religion and the liberal arts.

This honored and reverend seminary has taught thousands of men of talent to be wise and good citizens, avoiding avarice and pretense, ready for service wherever Providence might call them, in education, philanthropy, diplomacy, statesmanship, church-work, literature and science; not a few men of genius have submitted themselves to her discipline and acknowledged the inspiration derived from her counsels; some of her sons have laid down their lives for God and their country; many have carried to the ends of the earth her precepts and principles; all, or nearly all, have been the friends and supporters of republican institutions, the lovers of sound learning and good books, the promoters of science whenever their aid was wanted, its alert defenders against bigotry and alarm, confessors of the christian doctrine.

The new order which gives to adolescence an extreme freedom in the choice of studies may be more favorable than the old to the production of men of letters, poets, orators, historians, essayists—and of investigators who will extend the bounds of mathematical, physical and natural science. Nobody can tell. Every one is hopeful. But with all their gettings, may the new generation emulate their forebears in wisdom, self-control, sound judgment, and in hearty appreciation of all that books have recorded and all that nature has revealed.

Much reproach has been thrown upon the studies of colonial days because they were mainly directed toward theology and philosophy, and because there was so little study of the natural world. It is well to reply that nature studies are the growth of the last century, since Berzelius, Cuvier and Liebig initiated the modern methods of inquiry, carried on by Faraday, Darwin and Dana. Remember also that rigid discipline in logic and dialectics makes clear and accurate thinkers, fitted to treat the current questions of society with discrimination, perspicuity and persuasion. If our grandfathers did not excel in what we are pleased to call literature, they were taught to follow the rule of an illustrious writer, 'to use words coinciding as closely as possible with what we feel, see, think, experience, imagine and reason.' Such men were fitted to take part in the great Revolution of 1776, and in the war of 1861; to be influential in the formation of the Constitution of the United States, and in the administration of justice and order in every State of the Union, qualified likewise to lead in the organization and development of academies of science and schools of learning, defenders of the faith, upholders of right conduct, advocates of civil service reform, promoters of literature and science, and in general, trained by such discipline as they here received in mathematics, logic, history, language, philosophy and science, to be the leading men in every community where their homes were placed.

On fame's eternal camping ground
Their silent tents are spread,
And glory guards, with solemn round,
The bivouac of the dead.

DANIEL C. GILMAN.

THE GLASGOW MEETING OF THE BRITISH ASSOCIATION FOR THE ADVANCEMENT OF SCIENCE.

THE GEOGRAPHICAL SECTION.

THE president of the Geographical Section, Dr. H. R. Mill, took as the subject of his address the definition of the task of scientific geography and the subdivisions of the subject. In giving a brief review of the ideas of the older geographers, attention was called to an important, but well-nigh forgotten, work by Nathaniel Carpenter, fellow of Exeter College, Oxford, published 1625, under the title 'Geographie Delineated forth in two Books, containing the Sphericall and Topicall parts thereof,' a work characterized by a clear appreciation of the relations of the various subdivisions of the subject and by a clear perception of the good and the bad in the work of his predecessors and contemporaries.

Dr. Mill defined geography as 'the science which deals with the forms of relief of the earth's crust, and with the influence which these forms exercise on the distribution of all other phenomena,' and he divides the subject into: (1) Mathematical geography, which regards the earth as a spinning ball lighted and warmed according to a rigid succession of diurnal changes. (2) This merges into physical geography which is concerned with the contemporary changes in the crust and in the surrounding fluid envelopes. (3) Biogeography or the geographical distribution of life, and finally (4) Anthropo-geography or the relation of man to the earth's crust, a subject which must be separated for the more general third division on account of the number of exceptions it presents to the laws governing the distribution of the lower forms of animal life and on account of the exceptional powers possessed by man for modifying the conditions of the earth's surface. Viewed from this broad standpoint it is evident that enough attention has not been paid to geography by the universities. It is true that Oxford possesses a school of geography and Cambridge has a reader in that subject, while in this country physical geography receives most able attention in a few of our great universities; but more should be done towards coordinating the various subdivisions of the subject. Nowhere can this be better done than in the universities. Viewed in the broad sense, as outlined by Dr. Mill, geography would form a discipline worthy of a place upon our college curriculums; the practical advantages to be derived from a comprehension of the materials already in hand would be great both in direct results and in suggestions for future work.

Of this last Dr. Mill's address is a proof in itself and while many of his suggestions are more especially applicable to the needs of the British Isles, still some might be profitably carried out in connection with the surveys of this country. Thus maps showing the character of the superficial soil, such as the *cartes agronomiques* of France, would be a most valuable asset in the hands of any government and the same is true of carefully collated material with reference to the rainfall and configuration of stream-beds in different sections of the country, the horse-power of the rivers and streams being eventually determined from such data as has already been done in Finland. Mention may also be made of the population maps constructed by Mr. Bosse on the plan of indicating by dots the exact distribution of the population, the usual method of estimating population by counties or states giving but imperfect ideas of the true distribution. The population map of England shows in a most remarkable manner the relation of population to the geological character and configuration of the country and a knowledge of the conditions governing distribution in any country cannot fail to be of the

greatest importance from both political and sociological standpoints.

A number of papers describing itineraries in various portions of the world were presented to the section, but reference need be made to but few of these and of the more general topics discussed a few may be briefly mentioned. Professor Ireland, in a paper on 'The Geographical Limits of Popular Government,' maintained that climatic conditions unfitted the inhabitants of tropical regions for representative government, and in these regions the administration must be placed in the hands of trained Europeans. Dr. W. G. Smith presented an account of the botanical survey of Scotland, which is at present being carried out on the basis of a modification of the plan adopted by Professor Flahault of Montpelier. The entire flora is regarded as being composed of a number of 'plant associations,' in each of which there is one or more dominant species, and the object of the survey is to map out these associations. Maps of the associations of Northern Perthshire and of an area in the vicinity of Edinburgh have already been published and the work on Fife and Forfar is ready for publication. Professor Moreno, of the Museum of La Plata, gave an interesting account of the anthropogeography of the Argentine Republic, in the course of which he took the position that the races of South America were of great antiquity and that instead of the civilizations of Peru and Bolivia coming from the north, they were in reality much older than such civilizations as that of the Pueblos.

An account of the National Antarctic Expedition organized by the Royal and the Royal Geographical Societies was given by Dr. Scott Keltie, and Mr. W. S. Bruce described the plans of an expedition which he hoped to lead next year to the Weddell Sea and which he spoke of as the Scottish National Antarctic Expedition, since the expenses have been entirely defrayed by Scotsmen. Captain Lemaire gave an interesting account of the Belgian Scientific Expedition to Ka-Tanga, Central Africa, in 1897, and spoke in hopeful terms of the possibilities of the high plateaus of that region for European colonization, stating that all the usual European vegetables and many fruits had already been cultivated with great success. Finally, a paper by Dr. A. Lawrence Rotch, director of the Blue Hill Observatory near Boston, was presented under the title 'Exploration of the Atmosphere at Sea by Kites.' It was pointed out that on land the use of kites was possible only when the wind blew at a velocity of over twelve miles an hour, but on ships this difficulty was done away with, the motion of the vessel giving the desired velocity. The importance of some knowledge as to the height to which the trade winds extended and also as to the direction and strength of the higher currents was pointed out and the possibility of acquiring such knowledge by the use of kites was suggested.

A conference was held with the Geological and Zoological Sections for the purpose of discussing the scheme of a survey of the lakes of the British Isles which is to be carried out by Sir John Murray and Mr. Lawrence Pullar. It is intended to make a complete survey of each lake from all standpoints, bathymetrical, thermometrical, geological, botanical and zoological. Many interesting suggestions were made in the discussion which followed the reading of a letter by Sir John Murray stating the plans that he had formed for the work and a resolution was passed expressing the gratification of the Sections that such a survey was to be carried out.

THE ANTHROPOLOGICAL SECTION.

The address of the president of the Anthropological Section, Professor D. J. Cun-

ningham, of Dublin, was devoted to a consideration of the characteristics of the human brain and their significance. After pointing out the necessity for greater attention on the part of craniologists to the relations which exist between the brain and the cranium, reference was made to the discussions as to the relative development of the occipital lobe in man and apes, which enlivened the meetings of the Association forty years ago. With the knowledge we now possess it seems strange that such a discussion was ever precipitated, for not only is the occipital lobe largely developed in the ape, but it possesses even a greater development than in man. Measured along its medial border the percentage length of the lobe to the entire length of the cerebrum in the baboon, orang and man is, respectively, 29.7, 23.2 and 21.2, and even these figures do not show the full preponderance of the occipital lobe in the ape, for its anterior border extends so far forward as to overlap a portion of the parietal lobe and form an occipital operculum, a condition entirely lacking in man. Instead, then, of the preponderance of the occipital lobe being the distinguishing feature of the human brain, it is the greater relative development of the parietal, which encroaches to a certain extent upon the territory occupied in the lower forms by the occipital.

The conclusions of Rüdinger, derived from a study of the brains of a number of distinguished men, that the intellectual endowment of an individual stands in relation to the development of the upper part of the parietal lobe, Professor Cunningham believes to be entirely without foundation. Indeed, in the evolutionary development of the cerebral cortex it is the lower part of the lobe which shows the greater relative increase and has extended itself both backwards and downwards, the latter process leading to a marked depression of the Sylvian fissure to an extent quite foreign to the brain of any ape. And in this connection it is interesting to note that the recent studies of the brains of the astronomer Hugo Gyldén and of the mathematician Sophie Kowalewsky by Retzius, of Helmholtz, by Hansemann and of the musician Rudolph Lenz by Guszman, have all revealed an apparently marked development of the cortex of the lower parietal region. Furthermore, it is an interesting fact that in the left cerebral hemisphere the Sylvian fissure is more depressed than in the right. It is well known that physiologically the left hemisphere shows a decided preeminence, to account for which various theories have been suggested. That it is due to the greater bulk or weight of the hemisphere seems to have been disproved, nor can it be held to be due to the greater complexity of the convolutions, nor to a better blood supply.

What, then, may have been the cause both of this asymmetry and of the general development of the parietal lobe. Professor Cunningham points out that in the parietal region are the centers for the arm, hand, face, throat and mouth and, to a certain extent, the motor center for speech, and the center for the facial muscles. These latter, it is true, present a greater bulk in the ape than in man, but both they and the muscles governed by the other centers named are certainly more highly differentiated and capable of performing movements of greater refinement than in the ape, and it is this very degree of refinement which determines the amount of the area covered by a cortical center, rather than the mass of the organ supplied. On this basis, then, the greater development of the parietal lobe in man is readily explained, and since it is well known that the motor center for speech is asymmetrical and on the left side, an explanation is afforded of the asymmetrical development of the lower parietal region in

the human brain. Indeed Professor Cunningham holds that the "stimulus which must have been given to general cerebral growth in the association areas by the gradual acquisition of speech can hardly be exaggerated." "Some cerebral variation—probably trifling and insignificant at the start, and yet pregnant with the most far-reaching possibilities—has in the stem-form of man contributed that condition which has rendered speech possible. This variation, strengthened and fostered by natural selection, has in the end led to the great double result of a large brain with wide and extensive association areas and articulate speech, the two results being brought about by the mutual reaction of the one process upon the other."

Of the papers presented to the Section several were on matters of local archeology, Dr. R. Munro giving an account of a 'Kitchen-midden at Elie'; Messrs. J. G. Cunningham and Thomas Ross describing respectively Roman camps at Ardoch and Delvine and Dr. Duncan and T. H. Bryce reporting on 'The Results of their Excavations in the Island of Arran' where they found a number of skulls and implements evidently belonging to a prehistoric dolichocephalic race. Of somewhat more general interest were papers by Dr. J. F. Gemmill, who described the development of the human stapes, coming to the conclusion that it arose quite independently of the periotic bone and was developed from the hyoid, though not from its most proximal portion, this giving rise to the incus; by Mr. R. A. S. Macallister, on 'The Age of the Ogham writing in Ireland,' the conclusion reached being that for the most part the inscriptions were certainly christian in origin; and by Dr. Rivers, 'On the Functions of the Maternal Uncle in Torres Straits,' showing that the wife's brother was really the head of the house, even in tribes where the descent was now paternal. Especial interest attached to a paper by Mr. Brant Sero, a Canadian Mohawk, on 'Dekanawideh, the law-giver of the Canienghakas,' in which was given an account of the law still in use, with some modifications, among the Canienghakas or Mohawks of Canada and of which the salient principle was the establishment of a totemic council of women, who in turn elected an hereditary council composed of seven lords or masters, who made the laws and whose titles descended through the maternal line.

A report was presented by Mr. R. A. S. Macallister on the recent excavations made under the Palestine Exploration Fund, the main purpose of which had been the recovery of the city of Gath. Though the work in this direction had proved unsuccessful much material had been collected which throws light on the culture of the inhabitants of Palestine at different periods. At Tel-es-Safi, a height overlooking the valley of Elab, a building was found at the depth of 14 to 18 feet which there are reasons for regarding as one of the 'high places' mentioned in the Book of Kings.

A report was also submitted upon the results of the Cretan explorations. Excavations which were begun in 1900 have been continued at Knossus and have revealed an ancient palace which there are reasons for identifying with the traditional House of Minos. Upon the walls and floors of this were remains of a large series of frescoes among which are full-length figures of the cup-bearer, interesting as being the first known portrayal of a man of the Mycenæan age. The art remains evidence a high degree of skill and artistic perception, and several finds illustrate a close connection with ancient Egypt and Babylonia. The most striking discovery, however, is that of a series of clay tablets engraved with a linear script and demonstrating the existence in prehistoric Hellas of a system of writing antedating by about eight centuries the

earliest known Greek inscriptions, and by six or seven the first dated record of Phœnician script. In addition to the linear tablets others of a contemporary age were discovered inscribed with characters of a hieroglyphic nature, probably of an entirely different language. Excavations have also been carried on at Praseos, the capital of the ancient Eteocretans, and have yielded an inscription in Greek characters of the fifth century B. C., but composed in the Eteocretan language, and excavations at Zakro, in the extreme east of the island, revealed about 150 clay impressions of Mycenæan gems and signets, some of which throw new light on the early religion of Crete.

In connection with the meeting of the Section a pleasing incident was the formal opening of the new Anatomical Laboratory of the University of Glasgow, erected with the aid of a bequest from the trustees of the late Mr. J. B. Thompson. The chair was occupied by Lord Lister, and speeches were made by Mr. Barr in behalf of the Thompson trustees, Principal Story on behalf of the University, Sir William Turner and Professor Cleland, who has presented to the University his large collection of anatomical preparations. At the close of the speech-making the guests were entertained in the new laboratories by Professor and Mrs. Cleland and were given an opportunity of examining the arrangement of the rooms and the collections.

THE PHYSIOLOGICAL SECTION.

The opening address of the Physiological Section, delivered by the President, Professor J. G. McKendrick, was a consideration of the dilemma suggested by Clerk Maxwell in his article on the Atom in the Encyclopædia Britannica. The dilemma was to the effect that a germ cell cannot be structureless, yet it is too small to contain a sufficient number of molecules to account for all the characteristics which are transmitted by it. Professor McKendrick, on making calculations based on more modern data concludes that Maxwell's estimate of the possible number of molecules in an ovum is too small and instead of containing only something like a million the fecundated ovum may start with as many as twelve million million organic molecules, a number probably sufficiently great to account for the transmission of all hereditary characters. He also suggested that since the physicists conceive of molecules as being more or less in motion, it is possible that the activities of living matter may be due to a certain *kind* of motion as yet unknown to physicists.

Sir John Burdon Sanderson described the application of the telephone to the investigation of the rhythmic phenomena of muscles and detailed the results obtained by this method by Miss Buchanan, working in the physiological laboratory at Oxford, and which have already appeared in the *Journal of Physiology*. Professor Sherrington gave an account of experiments upon the cerebral cortical centers in two chimpanzees, the first experiments of the kind which had been performed on animals higher in the scale of life than monkeys. In one of the animals the cortical center for the hand was delimited and excised, the result being an immediate paralysis of the hand, which, however, in a few weeks completely passed away. In the second animal the center for the foot was similarly treated, with similar results. A study of the degenerated tracts in the first animal revealed the existence of a direct pyramidal tract in the spinal cord, a group of fibers which has hitherto been supposed to occur only in man. The degeneration resulting from the extirpation of the foot center did not affect this tract.

Dr. Kennedy, of Glasgow, described, with lantern views, a case in which a long-standing spasm of the facial muscles had been

greatly relieved by dividing the facial nerve and grafting its distal end upon the spinal accessory, the operation being an application of results obtained by experiments in nerve grafting performed on lower animals.

Professor Reed, of Dundee, pointed out that the assertion that proteids in solution exerted osmotic pressure was in all probability due to the use of impure preparations, since by using carefully washed recrystallized proteid no trace of such pressure could be obtained on a membrane formed of formalized gelatine. It would appear from this result that the so-called solutions of proteids were not true solutions but merely suspensions. Professor Reed also called attention to an observation he had made that the absorption of glucose by the intestine was favored by the presence of potassium salts as compared with those of sodium, and attributed the result to an ionic effect.

Dr. W. Brodie Brodie, of Glasgow, gave the results of experiments he had made on the action of oxalates on muscle tissue. He pointed out that it had been shown that the presence of calcium salts was necessary for the rhythmic contraction of the heart, and from his experiments it seemed probable that at the moment of muscular contraction there was a liberation of calcium from a salt of that metal present in the muscle substance. Oxalates did not destroy the irritability of resting muscles, although they did have that effect on muscles in a state of activity, and the results of previous observers require to be modified to this extent. It was probable that the action of the oxalate was due to the precipitation by them of the calcium liberated during contraction.

Professor Noel Paton reported on the results of observations made in conjunction with Drs. Gulland and J. S. Fowler on the hæmopoietic function of the spleen, and stated that they had not been able to obtain any evidence that the organ took part in the production of blood corpuscles.

Dr. W. H. R. Rivers gave an account of the measurement of a visual illusion in the cases of thirty-eight natives of Murray Island, Torres straits, compared with forty-two Englishmen. The apparatus used was the Müller-Lyer line with reversed arrow-heads, the standard line having a length of 75 mm. The illusion proved to be much less, on the average, among the islanders, to whom the two lines appeared equal when the movable line measured 60 mm. while the same appearance occurred to the Englishmen at 55 mm. Dr. C. S. Myers reported some observations which he had made with Galton's whistle on the same islanders, which showed that at all ages they were unable to hear as high a note as inhabitants of Buchan, Aberdeenshire.

THE BOTANICAL SECTION.

The presidential chair of the Botanical Section was occupied by Professor I. Bayley Balfour, who selected for his address a discussion of the causes which have led the Angiosperms to become the dominant type of the existing flora. Before the appearance of the Angiosperms upon the earth's surface there was a dense vegetation, composed of Pteridophytes and Gymnosperms, but this is now represented by a relatively small number of forms, having been replaced by Angiosperms. What, then, were the causes which have led to the dominance of this latter type, what are the structural peculiarities which have given it the advantage over its predecessors? The climatic differences of our epoch, contrasted with earlier periods, naturally suggest themselves as factors in the change, and of these differences perhaps the most important is the great difference in the relative proportions of the land and water areas upon the globe. "The statement is warranted that the Angiosperms have become dominant in great measure because in their construction the problem of the plant's relationship to

water on a land area has been solved more satisfactorily than in the case of the groups that preceded them."

By the formation of the flower and seed the Angiosperms freed themselves from the risks which attend sexual reproduction in heterosporous Pteridophytes by providing a special nidus for the development of the germ and thereby rendering it directly independent of the presence of water. The tegumentary system of the Angiosperm ovule has for its primary function the conveyance and storage of water for the embryo and in addition serves as a food reservoir. The function of the ovular tegmina cannot now be regarded as of so much importance in the reproductive act as was formerly the case, and the existence of haustoria which penetrate them, either from the embryo itself or the embryo-sac, point clearly to their function as reservoirs of food and water. In passing it was pointed out that the classification of the Dicotyledons into Unitegmineæ and Bitegmineæ proposed recently by van Tieghem seems to rest upon an insecure foundation, since all the genera in certain families, such as the Rosaceæ and Ranunculaceæ are not alike in respect to the number of teguments.

And it is not only to this development of special water reservoirs for the ovule that the Angiosperms owe their advantage as a land-type, but in two features of their water-carrying system they are greatly superior to the older types. No one will deny that their general monostely is a more perfect arrangement for water carriage in a massive plant than is polystely, nor is there doubt that the vasa which are conspicuous characteristics of the Angiosperms are more favorable for a rapid transport of water than are tracheids.

Passing on to a consideration of the differentiation of the Angiosperms into classes, Professor Balfour discussed the new class proposed by van Tieghem, that of the Liorhizal dicotyledons, and came to the conclusion that the two recognized families included in the class, the Nymphæaceæ and Gramineæ, do not present sufficiently distinctive characters to warrant their separation from the already established classes. The most recent observations on the embryogeny of the Nymphæaceæ seem to indicate that the apparent dicotyledonous nature of the embryo is due to the splitting of a simple cotyledon, and if this be correct the order is most properly assignable to the monocotyledons and the structure of the root-tip upon which von Tieghem lays so much stress is what might be expected. The idea that the epiblast of the embryos of the Gramineæ represents a second cotyledon, Professor Balfour is inclined to dispute, and points out that in any event its occurrence is not universal in the order, since it is present in *Triticum* and absent in *Secale,* present in *Elymus* and absent in *Hordeum.* The evidence as to the morphological significance of the structure is at present too obscure to warrant its being taken as a basis for the separation of the Gramineæ from monocotyledons.

Recognizing then but the two classes, Monocotyledons and Dicotyledons, the lecturer stated that if he were to express an opinion as to their phyletic relationship it would be that they had arisen on separate lines of descent. The Dicotyledons are by far the more adaptive and progressive, though this does not necessarily imply their more recent origin, and the advantages which they present over the Monocotyledons in their free internodal growth and copious root system as compared with the contracted stem growth and arrested root system of the latter, are but a carrying out of the structure of the embryo with its terminal plumular and root buds and its lateral cotyledons, so markedly different from what obtains in the Monocotyledons, in which the cotyledon is terminal, the plumu-

lar bud lateral and the primary root bud often internal.

As regards the genetic relations of the various groups into which the two classes are divided, Professor Balfour believes that there is "no evidence to sanction the belief, or even the expectation, that there is extant any family of Dicotyledons or Monocotyledons which represents, even approximately, a primitive type in either class. The stem in each has gone. We have the twigs upon a few broken branches."

The list of papers presented to the Section was somewhat extensive and mention can be made of only a few. Professor Letts and Mr. John Hawthorne submitted a report on some observations they had made upon the absorption of ammonia by *Ulva latissima*. They found that this sea-weed could absorb within twenty four hours all the ammonia from a sample of rather highly polluted sea-water (containing 0.046 parts of ammonia per 100,000) and suggested the possibility of this characteristic of the *Ulva* being turned to practical account. Professor Marshall Ward presented the results of his observations on the brown rust of the brome grasses. The seeds of the grasses could be treated antiseptically and sown in nutritive solutions and when inoculated with uredospores would give rise to pure cultures of the rust. The results gave no support to the idea that there might be an internal or seminal infection and it was found that although the uredo was in all morphological respects the same in all species on which they were grown, the spores grown on *B. sterilis* would never infect a plant of *B. mollis*, although they could be readily transferred to other plants of *B. sterilis*. Spores from *B. mollis* would infect its allies such as *B. secalinus* and other species of the *Serrafalcus* group, but failed on members of the *Stenobromus* group and so with other cases.

Mr. A. C. Seward described some sections of jet from Yorkshire which he had studied in the British Museum. Sections cut from specimens which consisted partly of petrified wood and partly of jet showed a gradual transition from Araucarian wood to pure jet lacking all indications of ligneous origin. It would seem from these sections that the Whitby jet was formed by an alteration of coniferous wood.

Other papers presented were on 'The Structure and Morphology of the Flowers of *Cephalotaxus*,' by Mr. W. C. Woodsell; 'The Histology of the Sieve-tubes of *Pinus*,' by Mr. A. W. Hill; 'A Contribution to our Knowledge of the Gametophyte in the Ophioglossales and Lycopodiales,' by Dr. W. H Lang; 'The Vascular Anatomy of the Cyatheaceæ,' by Mr. D. T. Gwynne-Vaughan; 'The Anatomy of *Danæa* and other Marattiaceæ,' by Professor Brebner; 'Spore Formation in Yeast' by Mr. T. Barker; and on 'A Diplodia Parasitic on Cacao and on the Sugar Cane,' by Mr. A. Howard.

J. PLAYFAIR MCMURRICH.
UNIVERSITY OF MICHIGAN.

SCIENTIFIC BOOKS.

Monographieen aus der Geschichte der Chemie herausgegeben von George W. A. Kahlbaum, IV. and VI. Hefte. CHRISTIAN FRIEDRICH SCHÖNBEIN, 1799–1868. Ein Blatt zur Geschichte des 19. Jahrhunderts von Georg W. A. Kahlbaum, Ed. Schaer und Ed. Thon. Leipzig. 1899 and 1901. 2 vols. 8vo. Portraits.

The previous volumes of this series of 'Monographs' have dealt with 'Lavoisier's Theory and its Acceptance in Germany,' 'Dalton's Theory of Atoms in Modern Light,' 'Berzelius' Growth,' and the 'Correspondence of Liebig and Schönbein,' by divers writers; the volumes before us deal with the scientific labors and personal character of the eminent chemist and physicist Schönbein by one who enjoyed superior opportunities for his undertaking, occupying a chair in the University of Basel analogous to that held by the famous man, and favored with the friendship of his living heirs.

Through the liberality of the daughters and numerous correspondents of Schönbein, Dr. Kahlbaum had the privilege of handling and studying between 1,500 and 1,600 letters, as well as 350 printed papers from the brain and hand of the man he sought to portray. These letters were carefully catalogued and partially indexed to make them readily available. While occupied with his manuscript, he learned that Professor Ed. Schaer, a pupil of Schönbein was also at work on a biography of him, and correspondence led them to produce a joint work.

Such is the origin of these volumes, which contain more than 550 pages.

The scientific labors of Schönbein comprise his discovery of the passivity of iron, that of ozone, of guncotton and of collodion, besides the many lesser points which in his indefatigable studies of these bodies he encountered. He discovered the remarkable behavior of iron with nitric acid shortly after he had begun his duties as professor of chemistry and physics at the University of Bâsle, in 1835. Dr. Kahlbaum notes that Schönbein's discovery had been anticipated by James Keir in 1790, but entirely forgotten and neglected. Schönbein's researches on electrical topics were continued many years until 1849, but meanwhile the study of that illusive substance, ozone, discovered in embryo in 1839, absorbed much of his energy. The early history of the enormously difficult problems connected with ozone and the fallacy of 'antozone' are detailed in a satisfactory manner.

No one of the discoveries made by Schönbein made him more popularly known than that of guncotton, destined to play so important a rôle in international, as well as industrial, enterprises; this dates from 1846. Its value as a substitute for gunpowder was at once perceived, and experiments with firearms were instituted as early as May of the same year. It is a sad commentary on the unprofitableness of pure science from the money point of view that this prime discovery brought to Schönbein only eighteen to twenty thousand dollars, while Alfred Nobel gained through it more than ten million dollars!

The discovery of collodion has been claimed for several Americans and Dr. Kahlbaum has made a careful study of these claims; it appears that Dr. Charles T. Jackson discovered the solubility of gun-cotton in January, 1847, and two of his students (Bigelow and Maynard) in February of the same year found the solution useful in surgical cases. The name collodion was given to it by Dr. A. A. Gould in 1848, by which time it was well known to American practitioners. The exact date of Schönbein's discovery is uncertain, but in February, 1847, De la Rive wrote from Geneva inquiring as to the nature of Schönbein's discovery 'here much discussed.' So it is clear that the invention was made on both sides of the Atlantic almost simultaneously and quite independently.

After pursuing studies at the Universities of Erlangen and Tübingen, Schönbein secured in 1825 the position of teacher in an institute at Epsom, England, and the two years he spent there had a marked influence on him through life. He attended at that time a lecture by Faraday, but did not seek his acquaintance; ten years later, having discovered the passive nature of iron in nitric acid, he addressed a letter describing this to Faraday, and this was the beginning of a correspondence and friendship lasting twenty-six years and only broken by the death of the Englishman. The 'Letters of Faraday and Schönbein' have been edited by Drs. Kahlbaum and Darbishire, and published in a handsome volume (London and Bâsle, 1899). Schönbein's correspondence with Liebig forms Heft V. of these *Monographieen*.

Notwithstanding the arduous labors of Schönbein in his university duties and in the chemical laboratory, he found time for conducting a large correspondence with his brother scientists, and also for writing to the secular daily press; from 1831 to 1832 he was associate editor of the *Basler Zeitung* on a salary of sixty dollars per annum; he was a frequent contributor to the columns of Stuttgart newspapers, and to the *Schwäbische Mercur* from 1833 to 1848.

The portrait in the first volume shows a heavily built, thick set man, smooth shaven and with full head of hair; his physiognomy is singularly earnest, without being so charming as that of Bunsen. The volumes contain indexes of names of persons and brief tables of contents.

Henry Carrington Bolton.

Die Krystallisation von Eiweissstoffen und ihre Bedeutung für die Eiweisschemie. Von DR. FR. N. SCHULZ. Jena, Gustav Fischer. Pp. 43. 1901.

Not many years have passed since it was customary for physiological chemists, following the suggestion of Thomas Graham, to class proteid substances as *colloids*, in distinction from the *crystalloids* which readily pass through diffusion membranes. The fact that native proteids are indiffusible no longer necessarily implies that they are not capable of crystallization. The achievements of recent years in the preparation of various proteids, both animal and vegetable, in crystalline form have marked a great advance in the study of this important group of organic compounds. The prominent rôle which the proteids assume in the life-processes of all organisms has long made them conspicuous objects of investigation; and now that the possibility of separating them in crystalline form has given promise of improvements in the methods of purification and identification, a new impetus has been given to the investigation of the chemistry of the proteids.

Professor Schulz's monograph is a comprehensive compilation of the literature on the crystallization of the proteids. It includes a review of the occurrence of proteid crystals ready-formed in animal and plant tissues, and a more extensive description of the separation and properties of crystalline preparations from non-crystalline native proteid mixtures. This includes in particular the crystallization of egg- and serum-albumin and the readily obtained vegetable proteids. Other less certain instances (fibrin, casein, heteroalbumose, etc.) are considered in the light of the evidence at present available. Hæmoglobin and related compounds are treated in somewhat greater detail, which their earlier discovery justifies. It is a matter of historical interest to note that Schulz names B. Reichert as the discoverer of the blood crystals (1847), whereas this honor is usually assigned to Otto Funke (1851).

In the concluding pages of Schulz's monograph brief reference is made to the crystallography of the proteid crystals and the significance of crystallization for the chemistry of the proteids. It is a satisfaction to American readers to find the American contributions to the literature of the subject adequately reported by a German writer. Dr. Schulz is a professor at Jena.

LAFAYETTE B. MENDEL.
SHEFFIELD SCIENTIFIC SCHOOL OF
YALE UNIVERSITY.

SOCIETIES AND ACADEMIES.

CHEMICAL SOCIETY OF WASHINGTON.

THE 128th regular meeting of the Washington Section of the American Chemical Society was held at Cosmos Club Hall, Thursday evening, October 10. The following program, was presented:

Dr. H. N. Stokes, 'Pyrite and Marcasite.' Dr. Stokes stated that the physical characteristics by which these geologically important dimorphous forms of iron disulphide are distinguished are not always applicable, especially when they occur in the form of concretions. The paper describes a method by which they can always be determined, which consists in boiling an excess of the carefully prepared mineral with a standard solution of ferric ammonium alum, under absolute exclusion of air, until the alum is completely reduced. The reaction takes place in two stages:

$$(1)\ FeS_2 + Fe_2(SO_4)_3 = 3\,FeSO_4 + 2\,S.$$

$$(2)\ 2\,S + 6\,Fe_2(SO_4)_3 + 8\,H_2O = 12\,FeSO_4 + 8\,H_2SO_4.$$

The second reaction is always incomplete, only a portion of the sulphur being oxidized to sulphuric acid. Under the standard conditions the percentage of sulphur oxidized is 60.4 in the case of pyrite and 18 in that of marcasite. The percentage of sulphur oxidized, or the *oxidation coefficient* (p), is obtained from the equation

$$p = \frac{8.333\,b}{c - a} - 25,$$

which is deduced from the above equations, and in which a, b and c represent the permanganate equivalents of the standard solution and of the ferrous iron and total iron of the resulting solution, respectively. The proportion of the minerals in a mixture of both can be

determined to within 1 to 3 per cent. by finding its oxidation coefficients and referring to an empirical curve of oxidation coefficients obtained by experiments with artificial mixtures. It was shown that the concretions described by geologists and mineralogists as marcasite are frequently pyrite, that the density affords no criterion of the composition, and that the hypothesis that most specimens of pyrite and marcasite, even when well crystallized, are mixtures of the two, or paramorphs, is without foundation. It was also shown that their behavior towards cupric sulphate solutions is essentially similar and affords no evidence in support of the hypothesis of Brown that the chemical constitution of the two minerals, or the state of valency of the iron is different. The full details are to be found in the recently published Bulletin No. 186 of the United States Geological Survey.

W. H. Seaman, 'Insolubility of Inorganic Salts in Hydrocarbons'; contribution from the laboratory of Howard University Medical College. The author stated that several years ago he had the pleasure of announcing to the society a generalization on the insolubility of glycerol ethers in glycerol. Now he is able to make a still more important generalization, that all inorganic salts are insoluble in hydrocarbons of the paraffin series. Fifty-three different salts have been kept in contact with benzine, kerosene and soft paraffin for periods varying from two to six months, without taking up a sufficient quantity of any salt to produce any residue on evaporation in a watch glass that is visible by a pocket microscope.

The writer does not know of a single analysis of petroleum in which the presence of inorganic salts has been reported, and in view of the fact that the petroleum has been in contact with some kinds of salts since it was formed, the natural conditions go far to support the generalization stated. Only in the case of $(NH_4)_2CO_3$ was there any marked change; a brownish color was generally developed when in contact with this salt, the cause of which is not ascertained. At the suggestion of Professor F. W. Clarke, anhydrous Fe_2Cl_6 was prepared and tested, but the result was the same. The following is a list of the salts used:

Ammonium sulfocyanid, bromid, phosphate, oxalate, carbonate, chlorid, nitrate; antimony sulfid; barium chlorid, nitrate, carbonate, dioxid; bismuth nitrate; arsenious acid; calcium chlorid and nitrate; ferric chlorid and ferrous sulfate; ferric ferrocyanid; magnesium carbonate; potassium bromid, cyanid, carbonate, iodid, bichromate, sulfate, chlorate; magnesium dioxid; potassium acetate; sodium bicarbonate, acetate, nitrate and sulfate; tartar emetic; zinc oxid; potassium ferrocyanid, chromate, hydrate, picrate, chlorid, nitrate; sodium borate, carbonate, chlorid, hydrate, nitrite, thiosulfate; ammonium molybdate, bichromate, sulfate; ammonia alum; magnesium sulfate and lithium carbonate.

L. S. Munson,
Secretary.

NEW YORK SECTION OF THE AMERICAN CHEMICAL SOCIETY.

The first meeting of the N. Y. Section of the American Chemical Society, held on Friday evening, October 11, at the Chemist's Club was very largely attended. Professor Marston Taylor Bogert, of Columbia University, is the newly elected chairman of this Section, which, on September 30 last, entered upon the second decade of its usefulness with a membership of over four hundred. Upon the recommendation of the Executive Committee, the Section decided to award annually a medal to that member of the Section who shall have presented, during the preceding year, the best paper embodying original chemical research. The minor conditions affecting the award and a suitable name for the medal will be decided upon later.

The program of papers included a report by General Secretary Professor Hale upon 'The Recent Meeting of the American Chemical Society, at Denver.' Dr. McMurtrie gave an interesting account of a 'Short Trip among the Mines, Smelters and Chlorination Works of the West.' Mr. Jacob G. Lipman, of the New Jersey Experiment Station, gave an account of his 'Studies in Nitrification.'

Professor Edward Hart, of Lafayette College, and Editor of the *Journal of the American Chemical Society*, read an interesting paper upon 'Technical Chemical Education,'

which brought forth a long discussion, participated in by prominent teachers of chemistry and industrial chemists. There seemed to be some weight of opinion in favor of the view that time may be spent in attempts to teach the details of such industries as dyeing, brewing, acid manufacture, etc., that might better be devoted to acquiring the broad general principles of chemistry, mechanics and engineering, leaving the technical training to be acquired in the factory or works.

Dr. H. W. Wiley, of the U. S. Department of Agriculture, gave a paper upon 'The Government Laboratories of Great Britain.' This was profusely illustrated by lantern photographs taken by Dr. Wiley. The director of this laboratory is Professor T. E. Thorpe, C.B., LL.D., F.R.S., past president of the Chemical Society. In regard to the equipment of this laboratory Dr. Wiley thinks we might do well to imitate its ideal system of ventilation and excellent apparatus. Solid silver flasks are used for saponification tests under pressure. On the other hand, British chemists in general will do well to imitate the American Society of Official Agricultural Chemists in regard to the adoption of standard analytical methods. In Professor Thorpe's laboratories some of the American 'official methods' have been adopted.

JOHN ALEXANDER MATHEWS,
Secretary.

THE ACADEMY OF SCIENCE OF ST. LOUIS.

AT the meeting of the Academy of Science, of St. Louis, on the evening of October 21, 1901, forty-five persons present, Professor F. E. Nipher, of Washington University, delivered an address on 'Progress made in Physics during the Nineteenth Century.'

WILLIAM TRELEASE,
Recording Secretary.

DISCUSSION AND CORRESPONDENCE.

PATAGONIAN PERSONALITIES.

A RECENT article in SCIENCE was none too soon in drawing attention to the puerilities and solecisms perpetrated by some botanists in their endeavor to grapple with the mysteries of the Latin language. We scarcely like to arouse the anger of zoologists by suggesting that they are just as bad, but at any rate some of them are not far behind. It is therefore satisfactory to hear that the International Congress of Zoologists has decided that errors of etymology, orthography and grammar are not to remain perpetual disfigurements of scientific writings simply because some would-be systematist never went to school. But there is a class of names against which there is no rule, appalling though they often are to the mind of the scholar. We allude to the monstrosities pieced up out of modern proper names, or even barbarous dialect words, often in unnatural union with a Greek or Latin suffix, *e. g.*, *Leedsichthys*, *Koninckocidaris*, *Lapworthura* (a polite way of showing respect truly!), *Etheridgaster* (which does *not* mean airy stomach), *Urobenus* (not, as some ingenious German supposes, derived from *ὀυρα* and *βαινω*, but an anagram of *Bournerus* by which a Mr. Bourne has been immortalized.

But all previous efforts—if one can dignify with such a term the results of pure laziness or incompetence—are left far behind by the latest fantasies of Florentino Ameghino in 'Notices préliminaires sur des Ongulés nouveaux des terrains crétacés de Patagonie,' published in the *Boletin de la Academia Nacional de Ciencias de Córdoba* (July, 1901). Zoologists may retort that this gentleman is only a paleontologist; well, then he should have more sympathy with the dead languages than to burden them with such abortions as the following: *Henricosbornia*, *Guilielmoscottia*, *Oldfieldthomasia*, *Ernestokokenia*, *Josepholeidya*, *Ricardolydekkeria*, *Guilielmofloweria*, *Henricofilholia*, *Thomashuxleya*, *Edwardocopeia*, and others too many to quote. Space, however, must be found for two gems, further enriched by footnotes: *Maxschlosseria* 'J'ai employé le prénom sous la forme germanique plus en usage, car c'est la racine du nom latin, qui est trop long,' and *Asmithwoodwardia* 'Je n'ai utilisé que l'initiale du prénom, car autrement il aurait résulté un nom excessivement long. D'ailleurs, cet auteur signe d'habitude A. Smith Woodward.' That 'd'ailleurs' is delicious; the man would actually find excuses for not giving us *Arturosmithivoodvardia*. Will the Zoological Congress

not insist on the completed form? Why should pure latinity dread an excessive length?

Seriously, is not this a little too much—not too long, but too childish? It is only 45 years since a satirical rogue in the *Annals and Magazine of Natural History* suggested that incipient paleontologists might ease their brains by adopting such combinations as *Grayoconcha* and *Gouldornis*, for they would certainly never have been anticipated by any zoologist. Such sarcasm would not carry far to-day; we have by this time rivaled the imaginary *Unclesambocrinus* of the same critic.

Ridicule will never check people with no sense of the ridiculous. Are rules any better? Needless to say the original Strickland code never contemplated the possibility of such aberrations; it was opposed to all personal generic names in zoology. The British Association Committee of 1864 wished to reject *Cookilaria* and *Morrhua tomcodus*, and considered that 'specific names from persons have already been sufficiently prostituted, and personal generic names have increased to a large and undeserving extent'; both are classed as '*objectionable.*' The rules adopted by the International Zoological Congress of 1899 say that generic names must consist of a single word (art. 5); that they may be derived from either forenames used in antiquity, or from modern surnames (art. 6 *g*, *h*); that such names should not enter into the formation of compound words (art. 9); that when a surname is compound, only one of its components is to be used, *e. g.*, *Edwardsia* not *Milne-Edwardsia* (art. 7) and certainly never *Milnedwardsia* (art 11). But *Amilnedwardsia*—!

It is perfectly obvious that the whole spirit of these rules is totally opposed to the action of Ameghino, and if their letter is not so too it is only because there are some things so ridiculous that nobody has ever dreamed of legislating against them. It remains to be seen whether the dignity, the common sense, and the fellow-feeling of zoologists are strong enough to ignore these Florentinameghinisms, which we should expect to see in some penny-a-liner's pseudo-scientific paragraph for a Sunday paper, rather than in the publications of a National Academy. F. A. B.

SOME REMARKS ON PRESIDENT D. S. JORDAN'S ARTICLE ON THE GEOGRAPHICAL DISTRIBUTION OF FISHES.

Professor D. S. Jordan has called attention to a number of highly interesting points in the geographical distribution of fishes,* and I should like to add a few remarks relating to some of the questions discussed.

1. *Similarity of Japanese and European (Mediterranean) forms.*

Although, according to Professor Jordan, this similarity does not seem to be so very much pronounced among fishes, we have other groups of marine animals in which the same striking fact has been noticed. The present writer has lately called attention to this with reference to the Decapod Crustaceans,† and has expressed the opinion that the connection of Japan and Europe by a continuous shore line was along the northern shores of Siberia, in a geological past when the climate of the circumpolar regions was a warmer one, so that at least subtropical animals could exist there. The continuous circumpolar distribution of the ancestors of the respective forms was broken up by the cooling of the pole, the species retreated southward, and found only in the Mediterranean and Japanese seas a congenial climate, where they continue to exist as *relics* of a former circumpolar distribution. Professor Jordan has apparently not taken into consideration this explanation, which might possibly also be advanced for some of the fishes of Japan and Europe.

2. *The submersion of the Isthmus of Suez.*

That there was no important connection between the Red Sea and the Mediterranean after the middle of the Tertiary is a well-known view. Hull‡ has demonstrated that the faunas of both seas were disconnected since Miocene time, but that in the Pliocene there was again an incomplete connection across the Isthmus of Suez by very shallow water. This agrees well with Professor Jordan's conclusions. Before Miocene, however, there must have been a wide

* 'The Fish Fauna of Japan, with Observations on the Geographical Distribution of Fishes,' Science, No. 354, October 11, 1901.

† Bronn's 'Klassen und Ordnungen des Thierreichs.' Arthropoda. Bd. 5, Abt. 2, p. 1,267. 1900.

‡ *Nature*, Vol. 31, 1885, p. 599.

and important communication between the Indian Ocean and the Mediterranean, as is shown by several interesting cases in the distribution of Crustaceans,* although it is impossible to say whether what is now the Isthmus of Suez played an important part in this question; the connection may have been somewhere else.

3. *The Cape of Good Hope as a zoogeographical barrier.*

Professor Jordan does not believe that the Cape of Good Hope offers an absolute obstacle to a migration of tropical Indo-Pacific species into the Atlantic. I do not hold the same opinion. Indeed, we know that the tropical fauna of the Indian Ocean extends southwestward along the coast of Natal and the Cape Colony, and some elements of it go even as far as Cape Town. But if we follow the shore line from here northward, along the western coast of Africa, we meet a considerable change of the climatic conditions, for from this point almost to the equator cold water is found. While it is thus true that the fauna of the Cape of Good Hope, as President Jordan says, shows a general relation to that of India and Australia, this applies only to the southern and the southeastern shores of the Cape Colony, while the western (Atlantic) side, together with the adjoining coast of southwest Africa, about as far as the mouth of the Congo, forms an impassable barrier to this tropical fauna of the Indo-Pacific.

4. *The Isthmus of Panama.*

It is beyond doubt that the Atlantic and Pacific Oceans were once connected with each other within the tropics: this connection existed up to the middle of the Tertiary, and it was closed during Miocene times. For this general assumption we possess an overwhelming mass of evidence. The question remains: Where was this connection of the two oceans situated? Formerly it was the general trend of opinion to assume a former depression of the Isthmus of Panama, but since Dr. R. T. Hill has shown that there are serious objections to this on geological grounds, we have to modify this theory. The present writer has tried† to do so with respect to v. Ihering's Archiplata-Archhelenis theory; the connection of the Atlantic and the Pacific in the Tertiary times was identical with the 'sea separating Archamazonas and Archiplata, that is to say, across the South American continent about where there is now the Amazonas valley'—the Cordilleras not existing then.

5. *Explanation of the distribution of Galaxias.*

The genus of freshwater fishes, *Galaxias*, is represented only in South Australia, New Zealand, South America and South Africa,* and it has been taken as one of the instances which demonstrate the former connection of these parts by land, the Antarctic continent. Professor Jordan hesitates to accept the latter, and his chief arguments are: (1) That this supposed continental extension should show permanent traces in greater similarity in the present fauna both of rivers and of sea, and (2) that geological investigation must show reasons for believing in such radical changes in the forms of continents.

As to the first point—although this connection is quite remote in time—the cases of similarity in the present marine, fresh-water and land faunas are *very* numerous, and there is hardly any larger group of animals where such are lacking. This fact has been discussed by a large number of writers,† and the wealth of evidence brought to light compels us to recognize this Antarctica theory as well established. As to the second point, the geological proof for existence of 'Antarctica,' I refer only to Professor J. W. Gregory,‡ who has shown that the tectonic configuration of Australia, New Zealand, South America and Antarctica —as far as we have any knowledge of the last—only tends to support the assumption of a former connection of these parts. That there is, generally speaking, ample reason for believing in 'radical' changes in the form of continents during the earth's history, has been demonstrated by geologists long ago, although it has become almost a fashion among biologists to disregard this line of evidence.

PRINCETON UNIVERSITY. A. E. ORTMANN.

* See Ortmann, l. c., p. 1276.

† In SCIENCE, No. 311, 14 December, 1900, p. 929.

* South Africa is not mentioned by Professor Jordan.

† The most important are mentioned by the present writer in the *American Naturalist*, 35, No. 410, Feb., 1901.

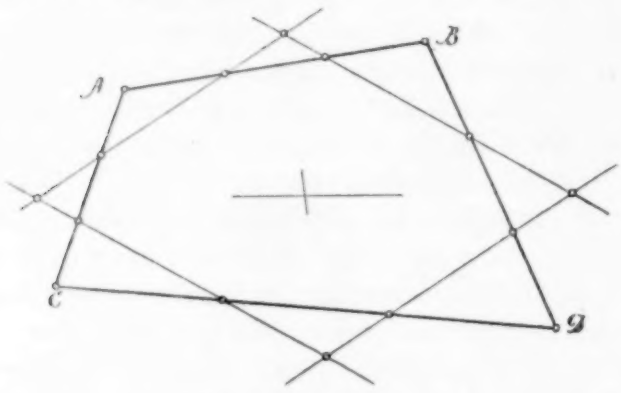
‡ *Nature*, Vol. 63, 25 April, 1901, p. 609.

SHORTER ARTICLES.

CENTROID OF A QUADRANGLE.

So far as I can ascertain, the following construction is new. If it be old, it would seem worth while to recall attention to it.

To find the centroid of any quadrangle *A*, *B*, *C*, *D*, divide each side into three equal parts, and draw lines through adjacent points of division, as indicated in the figure. It is easy to prove that the new figure is a parallelogram, the center of inertia of which coincides with the center of inertia of the original quadrangle, both occurring at the intersection of the diagonals of the parallelogram. The areas of the two figures differ.



In that admirable digest, 'Des Ingenieurs Taschenbuch herausgegeben vom Verein Hütte,' 17th edition, no less than thirteen constructions are given for finding the centroid of quadrangular figures. It would seem to me that one convenient and easily memorized construction should suffice, and that the space thus saved should be otherwise utilized.

G. F. B.

EFFECT OF DIMINISHED AIR-PRESSURE ON THE PULSE.

To the Editor of Science: In a recent trip to the summit of Pikes Peak I made some observations on the rate of my pulse which show a rapid increase of beat corresponding with a rapid decrease of pressure. The ascent was made from Manitou on the cog railway, and as I was comfortably seated all the way and spent most of the time looking from the car window, the influence of exercise on the results was eliminated, because there was no charge in this respect. The train stopped after each climb of about 2,000 feet to take on water and at these stops I took the rate of my pulse. The heights of the different points are taken from a guide furnished by the railway company, and these with the number of observed pulse beats per minute are given in the accompanying table.

Rate of Pulse per Minute.

Name of Station.	Height in Feet.	Rate of Pulse.	
		Ascent.	Descent.
Manitou.	6,662	78	78
Half Way House.	8,907	...	83
Gulch Tank.	10,067	85	85
Windy Point.	12,233	...	90
Summit Pikes Peak.	14,147	92	92

It is seen that the pulse increased regularly to the summit and decreased to the same amount on the way down. When near the summit I asked a lady sitting near me to give me her pulse rate and she found it the same as my own, namely, 92 per minute.

The average rate of my pulse at the same time of the day (near mid-day) at sea level is about 75.

The ascent was made on September 1, and the time occupied in the ascent and return was about four hours, between noon and 4 P. M. About an hour and a half was taken for the ascent and about an hour and a half for the descent, leaving about an hour for remaining on the summit.

I did not notice any difficulty of breathing while on the summit of the Peak, or any sensations markedly different from those experienced at sea level.

On the day of my visit the Peak was between two strata of cumulus clouds. One was evidently formed over the plateau to the west of the Peak and floated over some distance above the summit. The other stratum was formed over the plains to the east and was far below the summit of the Peak.

Henry Helm Clayton.

Blue Hill Observatory,
October 7, 1901.

NOTES ON INORGANIC CHEMISTRY.

The nature of an antimony salt described in 1882 by Setterberg has lately been cleared up by Wells and Metzger, writing in the *American Chemical Journal*. This salt was formed by the

addition of cesium chlorid to a solution containing both the trichlorid and the pentachlorid of antimony, and was considered to be a mixed salt. In recovering cesium from some residues containing antimony, the authors precipitated it as the chloroplumbate. Instead of being yellow, like the pure salt, the lead salt was bright green, and examination showed that it was colored by an antimony salt, which was isomorphous with it. This proved to be Setterberg's salt, and showed from its isomorphism that its constitution is Cs_2SbCl_6, containing therefore quadrivalent antimony. It crystallizes in black octahedra and belongs to the series of salts of which the most familiar member is the potassium chloroplatinate. This is the first known salt in which antimony is quadrivalent, although in the dioxid this valence is accepted by many chemists.

AN interesting application of the bioscope in crystallography is described in a paper recently presented to the American Academy of Arts and Sciences, by Professor Richards, of Harvard University, in conjunction with E. H. Archibald. The authors have studied the growth of crystals by photomicrography, taking successive instantaneous photographs of the growing crystal. This was accomplished with a very considerable degree of success, after overcoming very great mechanical difficulties. The object was especially to study the birth of crystals in order to determine whether crystallization is always preceded by the separation of an initially liquid phase, consisting of a supersaturated solution of the former solvent in its former solute. A number of observers have believed that with high microscopic powers they have detected the formation of minute globules at the moment of precipitation, and that these globules have soon joined and assumed crystalline form. The problem seemed possible of solution by taking a series of photographs of a solution just at the point of crystallization, and a large number of such photographs were obtained. The enlargement was over 4,000 diameters and both common and polarized light were used. In every case the earliest appearance of the crystal was distinctly crystalline, and no signs of globules were found. Hence if these occur preceding the crystal phase, they are too small to be detected in a microscope of the power used. Incidentally it was found that the growth in diameter in the first second of the crystal's existence was vastly more rapid than during the subsequent period. "This exceedingly rapid initial diametric growth accounts for a lack of definition noticed in the first images—a lack of definition sufficient to have misled the eye, but not enough wholly to obscure the photographic evidence of crystalline structure." The same apparatus is now being used for the study of the change in the structure of steel at high temperatures.

THAT the question of the influence of boric acid and borax upon the health has not yet been definitely settled is evidenced by two papers on the subject, which have recently appeared in the *Journal of Hygiene* and the *British Medical Journal*. The first of these, by Tunnicliffe and Rosenheim recounts a series of experiments upon children, continued for twelve days, and the authors draw the conclusion that these substances are practically harmless. The other paper by Gruenbaum combats the deductions of the former, chiefly upon the grounds that the experiments were too few, continued for too short a period and were upon children over the age when milk is the principal article of food. In the author's opinion the fact that the boric acid and borax were rapidly excreted by the kidneys is evidence of their poisonous character.

IN a recent number of the *Comptes Rendus* Chaveau and Tissot answer the question as to whether an atmosphere which has been rendered deleterious by the presence of hydrogen sulfid can act as a poison through the skin or the outer mucous membrane, in the negative. A dog, with a canula connected with the outside air in its trachea, was placed in a closed box containing more than eight per cent. of hydrogen sulfid. After an hour the dog was still in good condition, while another dog not thus protected, succumbed in the poisonous atmosphere almost instantly. The authors conclude from this experiment that hydrogen sulfid acts as a poison only when taken into the lungs.

J. L. H.

CURRENT NOTES ON PHYSIOGRAPHY.

DIKES AS TOPOGRAPHIC FEATURES.

DIKES are so generally the exclusive property of geological study that a good illustration of their topographic value is a welcome novelty. Rocky walls, shown by the removal of the weaker country rock from a vertical dike, have been occasionally mentioned in the reports of western surveys, but the finest example of the kind yet published is to be found in the Spanish Peaks (Colorado) folio of the U. S. Geological Survey, by Hills. Here a great number of dikes, arranged in a roughly radial pattern with respect to the denuded stocks of the Spanish peaks as a center, form numerous walls from 50 to 100 feet in height, stretching more or less continuously for five or ten miles or more. The weak horizontal Tertiaries have been worn away; but the dike wall retains some mark of their bedding, just as a casting shows the form of its mould. Several excellent photographic illustrations are appended; they are destined to frequent reproduction as type examples of this relatively rare class of topographic forms.

THE PLAIN OF ST. LAWRENCE VALLEY.

THE lower St. Lawrence valley is a broad and nearly level plain of post-glacial marine clays and sands, concerning which R. Chalmars gives some interesting information ('Notes on the Pleistocene Marine Shore-lines and Landslips of the North Side of the St. Lawrence Valley,' Geol. Surv. Canada, Ann. Rep., XI. (1898), 1901, 63J–70J). The height of the plain seldom exceeds 15 or 20 feet along the river bank, but it increases towards the valley sides, and reaches 400 or 500 at the base of the Laurentide hills. The junction of the plain with these hills forms a very irregular line, often running up the river valleys in loops for considerable distances. Generally speaking, this line can be traced approximately on a good map by the absence of lakes on the marine area, whereas on the Laurentide area lakes are quite numerous. Occasionally the surface of the plain is seen to ascend by steps, each of which has apparently been a shore-line during the emergence of the plain from beneath the sea. Terraces and beaches occur on the hill slopes above the plain; the highest reach altitudes of more than 800 feet.

Certain parts of the plain are subject to extensive landslips, apparently due to the sliding of water-logged silts into valleys that have been cut into the plain since its elevation. One in 1840 left a depression with a maximum depth of 30 feet below the adjoining plain over an area of 84 acres in the valley of Maskinongé river; this was described by Logan (*Proc. Geol. Soc.*, London, III., 1842, 767–769). The St. Albans landslip occurred in 1894; here the clays and sands slid bodily into the valley of the St. Anne de la Pérade for the space of 3½ miles, leaving a depression a mile wide and averaging 100 feet deep. (See Laflamme, *Trans. Roy. Soc. Canada*, XII., 1894, 63; and Archibald and Mackenzie, *Railroad Gazette*, N. Y., June 29, 1894.) The most recent large slip occurred in the valley of Rivière Blanche in 1898, leaving a depression over 86 acres in area with a maximum depth of 28 feet. The softer material flowed out from underneath, while the upper and more coherent clay split into blocks and columns which were borne away by the sliding, surging mass. The movement continued for three hours; clay masses being then left stranded on the floor of the depression, while the mud flow spread over the valley to a depth of twenty-five feet or more for nearly two miles. Accounts of this slip have been given by Dawson (*Bull. Geol. Soc. Amer.*, X., 1899, 484–490) and Laflamme (Rep. Comm'r Col. and Mines, 1898, 131).

THE QUESTION OF PENEPLAINS.

DE LAPPARENT considers the origin of several peneplains in France as determined by geological evidence ('La question de pénéplaines envisagée à la lumière des faits géologiques.' *Verh. 7ten Internat. Geogr. Kongr.* (1899), Berlin, 1901, II., 213–220). It is here not a question as to the occurrence of peneplains, now more or less uplifted and dissected; the French examples of this class of forms are so striking that the author does not regard their verity as a matter open to discussion. It is only their origin that he studies. The peneplains more fully described are found in the Ardennes, Brittany, and the Central Plateau. Strati-

graphic evidence leads to the conclusion that these regions have repeatedly been land areas, and that the successive invasions of the sea found the lands so low and flat as to offer no scarps for the sea to work upon. Regarding Brittany, it is remarked that littoral deposits somewhat to the north (bordering the Cotentin) have been produced in the same neighborhood and at altitudes differing only by a few meters during eleven different periods beginning with the Trias, thus indicating an astonishing stability of this region during the time of its denudation to the peneplain form. Marine erosion is therefore excluded, and the peneplains are ascribed to subaerial denudation.

W. M. DAVIS.

RECENT ZOO-PALEONTOLOGY.

FOSSIL REPTILES OF EUROPE.

THE latest paper upon the *Pterosaurs* is by Dr. Felix Plieninger.* Dr. Eberhard Fraas† proposes the name *Thalattosuchia* as a new group of marine crocodiles of the Jurassic formation, differing widely from all others in the extreme adaptation for aquatic life, especially in the total disappearance of the dermal armature and in the complete conversion of the limbs into paddles. The three chief genera *Metriorhynchus*, *Geosaurus* and *Dacosaurus* were placed by von Zittel in the family *Metriorhynchidæ*, of the suborder *Eusuchia*. But according to Fraas they deserve a wider separation, since while most nearly related to the long-snouted crocodiles (Longirostres), they by no means present a transition to the short-snouted (Brevirostres), but represent an entirely independent group, exclusively adapted to marine life. The superficial resemblance of the skull to that of Ichthyosaurs is intensified by the reduction of the characteristic crocodilian sculpture and by the ossification of the sclerotic coat of the eye. The details, however, are quite distinctive. This constitutes the fifth independent group of marine reptiles, the others being the Plesiosaurs, Ichthyosaurs, Mosasaurs and Chelonians.

* 'Palæontographica,' Vol. XLVIII., 1901.

† 'Jahresb. d. Ver. f. vaterl. Naturk. in Wurtt,' 1901, p. 408.

MARSH'S COLLECTION OF BRIDGER MAMMALIA.

THIS unique collection of Eocene mammalia has been placed by Professors Beecher and Dana, of the Peabody Museum, in the hands of Dr. J. L. Wortman for systematic description.* As Dr. Wortman remarks, "The importance of the subject to the student of mammalogy can scarcely be overestimated, since these epochs witnessed the beginnings and branching off of many groups destined to play such a prominent part in succeeding mammalian development. This fact was fully appreciated by Professor Marsh, and he spared neither pains nor expense in making the collections as complete as possible." In the first part, on the Carnivora, Dr. Wortman proposes an important and what may prove permanent change, in grouping with the modern Carnivores all the Creodonta that are closely related to them under the new suborder Carnassidentia, and retaining the suborder Creodonta (Cope) only for the ancient types that are entirely aberrant. Valuable notes are given upon the ancestral foxes of Wyoming, and the evolution is traced as far as the Uinta. The author believes that all the placentals had a direct marsupial ancestry, not far removed from the mesozoic carnivorous marsupials. Attention may be called to the fact, opposed to this view, that all the mesozoic marsupials known have a highly specialized character, with inflected jaw and aborted milk dentition, so that they cannot be considered ancestral to the placentals. The value of these papers for future reference would be increased by the insertion of the museum numbers in connection with all descriptions and figures.

PLEISTOCENE HORSES OF NORTH AMERICA.†

IN the preglacial sands of the west and the cave and gravel deposits of the east, remains of horses are extremely numerous; no less than twenty-five species have been proposed and the nomenclature has been in a state of dire con-

* 'Studies on Eocene Mammalia in the Marsh Collection, Peabody Museum,' Part I. Carnivora, *Amer. Jour. Sci.*, May and June, 1901.

† Tooth Characters and Revision of the North American Species of the Genus *Equus*. By J. W. Gidley. *Bull. Amer. Mus. Natural History*, Vol. XIV., Art. IX., pp. 91–141, May, 1901.

fusion. At the suggestion of Professor Osborn, Mr. J. W. Gidley, of the American Museum, has undertaken a complete revision of all the types. It is found that the chief characters used in definition by Owen, Leidy and Cope are largely invalid. The teeth patterns only subject to a wide range of individual variability, and it is an absolute law that the upper portion of the crown is not only more complex, but differs absolutely in proportion from the lower portion; the molar teeth of a young horse thus present essentially different characters from those of an old horse, and ignorance of this fact has vitiated most of the previous definitions. This very careful revision results in the apparent determination of the valid species as follows: *Equus fraternus*, a small horse from the southeastern States; *E. complicatus*, about the size of an ordinary draught horse, from the southern and middle western States; *E. occidentalis* from California, of the same size as the above; *E. pacificus*, a very large animal characteristic of middle California and Oregon; *E. conversidens* from the Valley of Mexico and *E. tau* the smallest true horse, also from the Valley of Mexico; *E. semiplicatus* from western Texas, closely resembling *E. asinus; E. pectinatus* from the Port Kennedy bone cave of eastern Pennsylvania. *E. scotti* from the Staked Plains of Texas. The latter is a long-faced type of horse about the size of the largest western pony, but with a longer body, a much larger head, a shorter neck and back and steeply sloping sides, shaped very much as in the ass or quagga. The type of this species is now mounted in the American Museum of Natural History (see Fig. 1). It is the first complete skeleton of a Pleistocene horse discovered in America. It was found in association with four other skeletons, remarkably well preserved. The largest species of horse herein recorded is *E. giganteus* Gidley; sp. nov., the teeth exceeding by more than one third the diameter of those of the largest draught horses.

H. F. O.

THE BICENTENNIAL COMMEMORATION OF YALE UNIVERSITY.

The imposing exercises celebrating the two hundredth anniversary of the foundation of Yale College took place last week in accordance with the program already published in this Journal. As President Northrop pointed out in his address, one hundred and five graduates of Yale have been president of a college; and eighty-five different colleges have at some time had a Yale graduate for president. Yale furnished the first president of at least eighteen colleges—Princeton, Columbia, Dartmouth, Georgia, Williams, Hamilton, Kenyon, Illinois, Wabash, Missouri, Wisconsin, Beloit, Chicago, California, Cornell, Western Reserve and Johns Hopkins. One of the most interesting addresses, given by Dr. Daniel C. Gilman, of the class of '52 and for twenty-five years president of the Johns Hopkins University, is published above.

The doctorate of laws was conferred on President Roosevelt and forty-six others, including the following men of science and college presidents:

John Harvard Biles, Professor of Naval Architecture in Glasgow University.

John Shaw Billings, Director of the New York Public Library.

Charles William Dabney, President of the University of Tennesee.

David White Finlay, Professor of the Practice of Medicine in Aberdeen University.

Jacques Hadamard, Adjunct Professor in the Faculty of Science at the University of Paris.

Samuel Pierpont Langley, Secretary of the Smithsonian Institution.

Albert Abraham Michelson, Professor of Physics in the University of Chicago.

William Osler, Professor of Medicine in Johns Hopkins Medical School.

Henry Smith Pritchett, President of the Massachusetts Institute of Technology.

Ira Remsen, President of Johns Hopkins University.

Ogden Nicholas Rood, Professor of Physics in Columbia University.

Wilhelm Waldeyer, Professor of Anatomy in the University of Berlin.

James Burrill Angell, President of the University of Michigan.

William Peterson, Principal of McGill University.

Seth Low, ex-President of Columbia University.

Jacob Gould Schurman, President of Cornell University.

Franklin Carter, ex-President of Williams College.

William Rainey Harper, President of the University of Chicago.

William Curtis Harrison, Provost of the University of Pennsylvania.

Francis Landey Patton President of Princeton University.

Benjamin Ide Wheeler, President of the University of California.

SCIENTIFIC NOTES AND NEWS.

THE National Academy of Sciences will hold a scientific session at the University of Pennsylvania, Philadelphia, beginning on Tuesday, November 12, at 11 a. m. A special stated session for the transaction of business will be held on November 13.

PROFESSOR GEORGE J. BRUSH, emeritus professor of mineralogy and formerly director of the Sheffield Scientific School of Yale University, received a loving cup from some of the former graduates, on the occasion of the recent bicentennial exercises.

THE first autumn meeting of the American Academy of Arts and Sciences was held at the house of Mr. Alexander Agassiz, president of the Academy, in Cambridge, Mass. After an introduction by the president and a statement for the Rumford Committee by Professor Cross, the Rumford medals were presented to Professors Barus and Thomson who responded with brief remarks. Mr. Agassiz then gave an account of the *Albatross* expedition to the tropical Pacific. George Wharton Pepper, of Philadelphia, was elected an associate fellow of the Academy.

THE Franklin Institute, of Philadelphia, has awarded to Dr. Porter Shimer, of the department of chemistry, Lafayette College, the John Scott legacy medal and premium for his improved jacketed crucible.

THE second annual Huxley lecture of the Anthropological Institute was delivered by Dr. Francis Galton, F.R.S., on October 29, his subject being 'The Possible Improvement of the Human Breed under the Existing Conditions of Law and Sentiment.'

THE Council of the London Mathematical Society for the ensuing year is as follows: *President*, Dr. Hobson; *vice-presidents*, Professor W. Burnside and Major MacMahon, R.A.; *treasurer*, Dr. J. Larmor; *honorary secretaries*, R. Tucker and Professor Love; *other members*, J. E. Campbell, Lieut.-Colonel Cunningham, R.E., Professor Elliott, Dr. Glaisher, Professor M. J. M. Hill, H. M. Macdonald, Professor L. J. Rogers, A. E. Western, E. T. Whittaker and A. Young.

DR. C. H. GILBERT, of the department of zoology at Stanford University, has been appointed to take charge of the deep-sea investigations of the United States Fish Commission about the Hawaiian Islands. He will leave on the Government ship *Albatross* about December 1.

THE Navy Department has selected Lieut.-Commander W. H. H. Southerland to succeed Capt. C. C. Todd as chief hydrographer of the navy, and orders have been issued detaching him from the command of the *Dolphin*.

WE regret to learn that Mr. Thomas Meehan, the well-known horticulturist, is seriously ill.

DR. THEODORE HOUGH, of the Biological Department of the Institute of Technology, is at his Virginian home convalescing from a long attack of typhoid fever.

AN intercollegiate geological excursion was made to the Westfield valley in Central Massachusetts on Saturday, October 19, for the purpose of studying the formation of river terraces and the influence of rock ledges on their development. The excursion was under the leadership of Professor W. M. Davis, and was attended by forty-six teachers and students from twelve institutions—Yale, Amherst, Wesleyan, Williams, Mass. Institute of Technology and Harvard; Milton and Worcester Academies, Springfield High School and Westfield, North Adams and New Britain Normal Schools. Professors B. K. Emerson, H. E. Gregory, W. N. Rice, and R. T. Jackson were members of the party.

MRS. STANFORD has returned to San Francisco after a journey to Egypt, where she purchased for the Stanford Museum a valuable collection of Egyptian antiquities.

MR. H. KATO, of the Japanese Department of Agriculture, is at present in the United States, with the purpose of studying our fisheries.

DR. D. MORRIS, the British commissioner of agriculture for the West Indies, has returned to Barbadoes after a visit to London.

We learn from *Nature* that Mr. J. R. Jackson, who for a period of forty-three years has been associated with the Royal Gardens, Kew, has resigned the keepership of the Museum of Economic Botany, and is succeeded by Mr. J. M. Hillier, whose place, in turn, has been taken by Mr. J. H. Holland, late of the botanic station at Old Calabar.

Mr. Keith Lucas, B.A., of Trinity College, Cambridge, has been nominated to occupy the university table at the laboratory of the Marine Biological Association at Plymouth.

Dr. Oliver Lodge, formerly professor of physics at University College and now the principal of Birmingham University, delivered the opening address to the medical students of University College, Liverpool, on October 12. At the close of the proceedings a bust of Dr. Lodge was unveiled by Professor W. A. Herdman.

The death is announced of Dr. Vonkrafft, of the Geological Survey of India.

Mr. Andrew Carnegie has offered to provide libraries at San Juan, Porto Rico and Nashville, Tenn., each at a cost of $100,000. He has also given £37,000 for libraries at Dundee.

Mrs. Blackstone, widow of T. B. Blackstone, has offered to give the city of Chicago a $100,000 library building, to be conducted as a branch of the public library.

Dr. Frederick Peterson offers a prize of $200 for the best original unpublished contribution to the pathology and treatment of epilepsy. Papers received will be submitted to a committee, consisting of three members of the New York Neurological Society, and the award will be made upon its recommendation at the annual meeting of the board of managers of the Craig Colony, October 14, 1902. Manuscripts should be sent to Dr. Frederick Peterson, 4 West Fiftieth street, New York City, on or before September 30, 1902. The successful essay becomes the property of the Craig Colony and will be published in its medical reports.

For a number of years archeological expeditions to Iceland and Greenland have been conducted at the expense of the Danish 'Carlsberger Funds.' The directors have now decided to defray the expenses of Dr. Kinde in making excavations on the Island of Rhodes, especially in the neighborhood of the ancient Acropolis.

Arrangements have been made at the Millport Marine Biological Station, Scotland, for the erection of a research laboratory and also of a private boarding house. The site for the new buildings has been promised by the Marquis of Bute, and a gentleman who prefers to remain anonymous has given £3,000 towards their erection.

The German Society of Men of Science and Physicians will hold its meeting next year at Carlsbad under the presidency of Dr. Hans Chiari, professor of pathological anatomy at the German university at Prague.

The annual trip of the German Agricultural Society in 1903 will be made to the United States.

Foreign papers report the formation at Cape Town of a 'South African Association for the Advancement of Science,' to work as far as possible on the lines of the British Association. In July last a meeting was held to establish a congress of engineers, when an influential committee was appointed. The proposal gradually widened until at length it was found feasible to establish a local 'British Association,' and a meeting for that purpose was largely attended. Sir David Gill, the Astronomer Royal at the Cape Observatory, who presided, mentioned that in November last he had attended a meeting of the council of the British Association, at which a very strong desire was expressed to have a meeting of the British Association held in South Africa. He was sure, he said, that in the event of such a visit the hospitality of Cape Town and Kimberly and other centers would be quite equal to the strain which would be put upon it by the visit of distinguished men of science. Of course in the existing state of political affairs it was impossible to contemplate such a matter seriously, and they must leave the fuller consideration of the matter until the country was settled and they were in a position to exercise that hospitality. But if they founded some association of the kind now indicated, the year that the British Association came to South Africa they should naturally merge their meeting into that of the British Association, and their organization would natu-

rally facilitate matters and aid them in making a successful meeting when the British Association came there. Their primary object would be to found an association as far as it was practically possible on the lines of the British Association. The formation of the association having been decided upon by formal vote, the title was discussed, 'South African' being carried by 31 votes against 19 for 'African.'

THE Spanish minister of education has ordered that hereafter all museums shall be open the year round free, and any one allowed to make copies of photographs. He also requested teachers to take their pupils frequently to the museums.

A REPORT of the committee of the metric system has been presented to the British Association of Chambers of Commerce. The committee has unanimously adopted the following resolutions: "(1) That, after considering various suggestions, this committee is unanimously of opinion that the chambers should unite in urging upon the government the compulsory adoption of the metrical system of weights and measures, leaving matters of detail to be considered later. (2) That the committee is unanimously of opinion that a British decimal system of coinage must be on the basis of retaining the sovereign, with the florin as a unit, divided into a hundred cents or farthings. (3) The committee recommends that there should be nickel coins of five and ten cents, and bronze coins of one, two and four cents or farthings."

THE greatest steamship of the time, the *Celtic* of the White Star Line, has made her 'maiden' passage across the Atlantic and back, and her first record—8 days, 9 hours, 46 minutes running time, excluding the time lost by fog, which happened to be in this case 15 hours. This is, for the present at least, the largest steamship in the world. The *Oceanic* of the same line is five and a half feet longer but of less beam and tonnage. The *Celtic* is 700 feet 'over all,' of 75 feet beam and 49 feet depth, measuring 20,880 tons. The *Great Eastern*, for a half century the largest ship on the lists of the fleets of the world, was 680 by 84 by 48 feet, registering, gross, 18,000 tons. The *Celtic* is the first ship to exceed that, at the time, wonder of the world, largely the basis of the fame of Brunel and Russell. The total weight—the 'displacement'—of the new ship, at maximum computed draft, 36 feet 6 inches, would be nearly 38,000 tons, as compared with about 32,000 tons for the *Great Eastern*. The largest naval vessels are of about one-half this last weight. The *Campania* registers about 13,000 tons, the *Kaiser Wilhelm der Grosse* 17,000, the *Deutschland* 16,500 and the *Oceanic* 17,250. The engines are of the quadruple-expansion type, 33, 47.5, 68.5 and 98 inches diameter of cylinders and 5 feet piston-stroke. Steam-pressure is carried at 210 pounds per square inch by gauge, and is produced by 8 double-ended 'Scotch' boilers, each 15.5 by 19.5 feet. The two smokestacks are each 14 feet in diameter. The ship has capacity for 2,700 passengers or more and for 12,000 tons weight of merchandise. The cost of this ship was $2,500,000. The builders were Messrs. Harland and Wolff.

A REUTER telegram reports that the Liverpool School of Tropical Medicine has now completed the necessary arrangements for the dispatch of an expedition at once to the Gold Coast, and to the mining districts there. The school has secured the services as leader of this expedition of Dr. Charles Balfour Stewart, who will sail for West Africa this month. He will proceed first to Sierra Leone in order to study the methods now being employed there by Dr. Logan Taylor. After leaving Freetown, Dr. Stewart will proceed at once to Cape Coast Castle to attack the insanitary conditions there, as the mortality amongst the Europeans in that town is at present most serious. He will employ workmen for draining the ground and clearing the houses o broken water vessels and otherwise attacking the breeding-grounds of the mosquitoes. The expedition has been rendered possible owing to the generosity of a private ndividual who desires to remain anonymous. Anti-malarial operations will shortly be in all swing in Gambia, Sierra Leone, the Gold Coast and Lagos, the operations in the three first-named colonies being organized by and under the complete control of the Liverpool School of Tropical Medicine. Dr. Stewart received his professional

education at Cambridge, the Liverpool Royal Infirmary and Guy's Hospital, London. After qualification, he studied specially at Vienna and Freiburg. He was then invited by the Secretary of State for India to proceed to India for plague work; and labored both up country and also as an assistant to M. Haffkine in the Imperial Research Laboratory at Bombay. He then returned to England and has been constantly engaged in the Thompson Yates Laboratory, Liverpool, on research and the preparation of plague prophylactic, by the request of the Secretary of State for War and the Agent-General of Cape Colony.

UNIVERSITY AND EDUCATIONAL NEWS.

MR. T. JEFFERSON COOLIDGE, late Minister to France, has given a fund of $50,000 to the Jefferson Physical Laboratory of Harvard University for physical research. The income is to be expended at the discretion of the director, Professor John Trowbridge. Among the terms of the gift is the following: The income of this fund shall be used primarily for laboratory expenses of original investigations by members of the laboratory staff; but the director, at his discretion, may award therefrom an honorarium, of not more than $500 per annum, for the private use of any person who—although receiving no salary from the university—may wish to carry on original investigations under his direction at the Jefferson Physical Laboratory.

THE General Electric Company has agreed to give $12,500 for the establishment of a school of electricity at Schenectady, provided that an equal amount is secured from other sources. The school would be affiliated with Union College. It will be remembered that the New York legislature was asked last year to establish this school.

AT the final meeting of the committee engaged in founding a fellowship at the New York University, in memory of the late Oswald Ottendorfer, held recently, plans were made for turning over the amount of subscriptions to the University. The treasurer, James Speyer, reported that the fund aggregated $20,199.85.

MR. GEORGE A. ARMOUR has given $2,500 a year for five years for the maintenance and development of the classical seminary at Princeton University. The university is the residuary legatee of the estate of Dr. John Sayre of Missouri, $15,000 of which is now available. It has also lately acquired, through the gift of an unnamed donor, the property of the late Professor Guyot.

MR. EDWARD B. PAGE, of New York, has given to the Sheffield Scientific School of Yale University, $6,000 to found scholarships.

ON the occasion of the laying of the corner stone of the new medical building of the University of Michigan, Dean Vaughan announced that a few prominent medical alumni of the university had established a fellowship in connection with the medical department, to be known as the Corydon L. Ford Fellowship, in memory of the first professor of anatomy in the university.

PRESIDENT ANGELL, of Michigan University, announces that an instructor in forestry is soon to be appointed.

PROFESSOR W. D. GIBBS, of the Ohio State University, has been elected professor of agriculture and director of the experiment station at the New Hampshire College of Agriculture and the Mechanic Arts at Durham, N. H.

PROFESSOR ARTHUR W. SMITH, who was at Tulane University last year, has been appointed professor of electricity and electrical engineering at the University of Mississippi.

MR. ANDREW CARNEGIE has accepted the Lord Rectorship of St. Andrew's University for the ensuing three years.

DR. JOHN PURSER, for forty years professor of mathematics in the Belfast Queen's College, has retired.

PROFESSOR W. SOMERVILLE, having accepted post at the Board of Agriculture, will resign the chair of agriculture at Cambridge University at the end of the present term.

PROFESSOR RÜDORFF, director of the Laboratory of Inorganic Chemistry in the Technical Institute of Berlin, has retired on account of his health.

PROFESSOR MAX WOLF, of Heidelberg, has declined the call to the professorship of astronomy at the university at Göttingen.